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DEPARTMENT OF NATURAL RESOURCES
WARREN T. HANNUM, Director

FORTIETH BIENNIAL REPORT

OF THE

DIVISION OF FISH AND GAME

FOR THE YEARS 1946-1948

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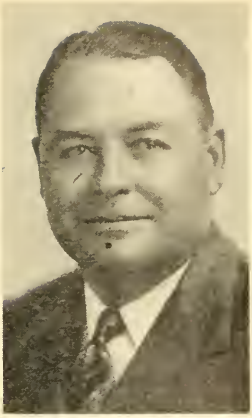
DEDICATION

To state officials and legislators who have labored diligently to achieve a wise conservation policy for the protection of our natural resources, to the hunters, anglers and commercial fishermen who have harvested a portion of our crop of game and fish, and to other citizens who have enjoyed the great outdoors and association with the wildlife of the Golden State, this biennial report of accomplishments and progress is dedicated. May its perusal result in a firmer alliance of those who are striving for the protection and development of the wildlife resources of California.

WARREN T. HANNUM
DIRECTOR OF NATURAL RESOURCES



HARVEY E. HASTAIN
PRESIDENT, FISH AND GAME COMMISSION

LEE F. PAYNE
COMMISSIONER

WILLIAM J. SILVA
COMMISSIONER

PAUL DENNY
COMMISSIONER

EDWIN L. CARTY
COMMISSIONER

E. L. MACAULAY
EXECUTIVE OFFICER

LETTER OF TRANSMITTAL

July 1, 1948

To His Excellency, Earl Warren
Governor of the State of California
Sacramento, California

Sir: We, the members of the Fish and Game Commission, respectfully submit the Fortieth Biennial Report, covering the period July 1, 1946, through June 30, 1948.

The report is a brief resume of the activities of the Fish and Game Commission; a report by the Executive Officer; and detailed reports of the functions of the various bureaus by their respective chiefs. There also are included complete fiscal reports and tabulations on fish and game management.

Respectfully submitted,

California Fish and Game Commission
Harvey E. Hastain, President
Lee F. Payne
William J. Silva
Paul Denny
Edwin L. Carty

REPORT OF THE FISH AND GAME COMMISSION

At the start of the biennium, the Fish and Game Commission consisted of:

Lee F. Payne, President	Los Angeles
William J. Silva	Modesto
W. B. Williams	Alturas
Harvey E. Hastain	Brawley
H. H. Arnold	Sonoma

Personnel changes in the Commission as effected during the following two years were:

Paul Denny, of Etna, appointed June 19, 1947, vice W. B. Williams, term expired.

Edwin L. Carty, of Oxnard, appointed April 27, 1948, vice H. H. Arnold, resigned April 6, 1948.

At the close of the biennium, the membership of the Commission was as follows:

Harvey E. Hastain, President	Term expires 1951
William J. Silva	Term expires 1950
Lee F. Payne	Term expires 1952
Paul Denny	Term expires 1953
Edwin L. Carty	Term expires 1949

E. L. Macaulay was appointed Executive Officer of the Commission, May 10, 1948, following the resignation of Emil J. N. Ott, Jr., on April 30, 1948.

LEGISLATION

A few changes in the Regulatory Power Act were made by the Legislature during the 1947 Session:

(1) Meetings of the Commission in relation to establishing hunting regulations were advanced from the month of June to April.

(2) The act itself was extended for another two-year period.

Two other measures of considerable importance were enacted, the Wildlife Conservation Act of 1947, and the Pacific Marine Fisheries Compact. The value of both these enactments will be realized for many years to come by the commission, the division, sportsmen and those connected with the commercial fishing industry.

To best illustrate the intention of the Wildlife Conservation Act and its widespread purposes, we quote the first section thereof:

"It is hereby declared that the preservation, protection and restoration of wildlife resources within the State of California is an inseparable part of providing adequate recreation for our people in the interest of public welfare; and it is declared to be the policy of the State to acquire and restore to the highest possible level, and maintain in a state of high productivity those areas that can be most successfully used to sustain wildlife and which will provide adequate and suitable recreation. To carry out the

aforesaid purposes, a single and coordinated program for the acquisition of lands and facilities suitable for recreational purposes and adaptable for conservation, propagation and utilization of fish and game resources of the State is hereby established."

With these laudable purposes, the Legislature created in the Department of Natural Resources, the Wildlife Conservation Board, consisting of three members: The President and Executive Officer of the Fish and Game Commission and the Director, Department of Finance. An advisory committee of three Senators and three Assemblymen was also established.

The powers of the board and certain rules of procedure were outlined, and a companion bill enacted to provide from the revenue of the Horse Racing Fund the sum of $3,000,000 per year for three years for the board to use in carrying out the purposes as expressed in the act.

Proposed projects were to be thoroughly investigated and appraised, and, upon approval by the board, assigned to the Fish and Game Commission, with necessary funds for acquisition and construction of facilities.

This "aid to wildlife" will permit the commission's regular revenue from license fees, fines, etc., to be used for the operation and maintenance of the many installations required by the tremendously increased number of hunters and anglers.

The Pacific Marine Fisheries Compact was enacted to enable the State of California to cooperate with the states of Oregon and Washington in the formation of a Pacific Marine Fisheries Commission.

The purposes of the "compact" are to promote the better utilization of fisheries which are of mutual concern, and to develop a joint program of protection and prevention of physical waste of such areas of the Pacific Ocean over which the above-named states have jurisdiction, and to prepare and present legislation to carry out the finding of the commission in the respective states.

The economic value of this agreement will result in continued operation of the commercial fishing industry and its allied industries for many years to come, as regulations for seasons, take, etc., will be based on the research findings and statistics of the coastal states.

REPORT OF THE EXECUTIVE OFFICER

With the start of the new biennium, the Bureau of Game Farms was abolished, following the retirement of its Chief, August Bade. The supervision and management of the farm was assigned as a function of the Bureau of Game Conservation.

The plan of reorganization of the functions and activities of the various bureaus of the division, prepared during the previous biennium, has been effected, with such additional changes as developed, for greater efficiency in administration and management.

The following personnel changes are worthy of note:

Bureau of Patrol:

L. F. Chappell appointed Chief, May 10, 1948
A. A. Jordan appointed Assistant Chief, August 1, 1947
S. R. Gilloon appointed Assistant Chief, April 1, 1948
O. P. Brownlow retired, December 31, 1946
Walter Engelke retired October 31, 1947
Walter Emerick retired April 1, 1948
Walter R. Krukow, deceased, April 20, 1947

Bureau of Marine Fisheries:

Richard S. Croker appointed Chief, September 1, 1946
S. H. Dado, retired, June 30, 1948

Bureau of Fish Conservation:

Earl Leitritz, appointed Supervisor of Fish Hatcheries, October 16, 1947, vice A. E. Burghduff, retired, October 15, 1947

Bureau of Game Conservation:

Ben Glading appointed Assistant Chief, August 25, 1947, vice Gordon H. True, Jr., retired, August 1, 1946

CONSERVATION EDUCATION

During the biennium, several of our silent motion pictures were reedited into shorter versions, and sounded. "More Trout for the Creel," showing a few typical fish hatcheries, methods of propagation and planting in lakes and streams became very popular and continues as a most interesting and educational project. Picturing and describing the construction and use of the watering devices, "More Quail for the Deserts" is a very fine film for instructional purposes. "Game Farms and Ringnecks" shows the production program of our game farms and the release of pheasants. "Sardines for Supper" well illustrates the commercial fishing, canning, and processing industries.

The sounding of our pictures enabled loaning of these films without the necessity of our personnel taking projection equipment, thus effecting considerable saving in travel expense, and at the same time providing greater distribution and use, by adult groups, and in school assemblies.

Films and projection equipment were supplied for the San Francisco, Sacramento and Los Angeles offices.

Showings by personnel of these offices and by loans approximated the following:

Schools	210
Sportsmen's clubs	135
Service organizations	175
Other groups	70
	590

Attendance at these showings and at meetings where our personnel were requested to speak on definite topics is estimated at close to 97,000 men, women and children.

Plans are under way for additional films, and revisions of some present subjects, in order to obtain greater use in school classes, and increasing the knowledge of California's wildlife resources and the division's activities in conservation, propagation and management.

PUBLIC INFORMATION

Despite the personnel turnover, the public information section of the division was considerably improved. The need for a vigorous informational program was recognized, and the support of the various bureaus of the division was given in supplying data of interest to sportsmen and laymen.

The press release "Outdoor California" was expanded from a one-page affair to an average of five mimeographed pages per week with a mailing list of over 3,000 names. Selected radio stations and newspaper columnists were included in an effort to obtain wider dissemination of conservation news material. Many editors were supplied with stock photographs portraying hunting, fishing or conservation activities.

The *Service Bulletin*, a publication for our own personnel, was revived, and became a medium of useful information for the employees of this division.

This section participated in displays at the 1947 State Fair, and at sportsmen-sponsored shows in Oakland, San Francisco and Los Angeles.

Experiences gained during this past biennium clearly indicate the necessity for better relations between the commission, its personnel, and the license-buying public, in the presentation of information, educational or otherwise. This will establish the public's faith that the commission is only concerned in the welfare of the wildlife of California, that the hunters and anglers may have opportunities to obtain their fair share, and that the coming generations, too, may enjoy some of the privileges we now have.

LIBRARY

The library, under the supervision of the executive officer, continued to carry out the division's policy of furnishing assistance to the field and office force in furtherance of their studies and problems connected with fish and game.

During the biennial period, the inventory included 4,036 bound volumes and 9,588 scientific pamphlets; all having been catalogued, they form a sizeable, valuable, bibliographical collection.

Many requests from sportsmen, schools, and the general public for free copies of division publications, and for reprints from *California Fish and Game* were received and processed. The lending section of the library has increased proportionately with the growth in number of employees.

PUBLICATIONS

Eight issues of the quarterly magazine *California Fish and Game* were published during the biennium, with 5,000 copies being printed of each issue. A total of 542 pages were necessary for the 73 articles of scientific value, the many "news notes," reports, fiscal statements, indexes to volumes, and lists of personnel. Increased interest of hunters and fishermen in division activities, plus added enrollments in colleges have increased the demands for this worth-while periodical.

FISCAL

Complete financial statements for the biennium will be found in the appendix of this report. However, the following graphic charts show in summary the receipts and disbursements for the two-year period.

Attention is called to the fact that these charts are made up in accordance with the internal structure of the division, and, that in regard to purpose of expenditure, there is considerable overlapping of functions. From the charts, it looks as though the Bureaus of Patrol and Licenses were "sponging" off the revenue of the other bureaus; whereas, if it were not for their activities there would be but *very* little revenue derived from sales of hunting and fishing licenses.

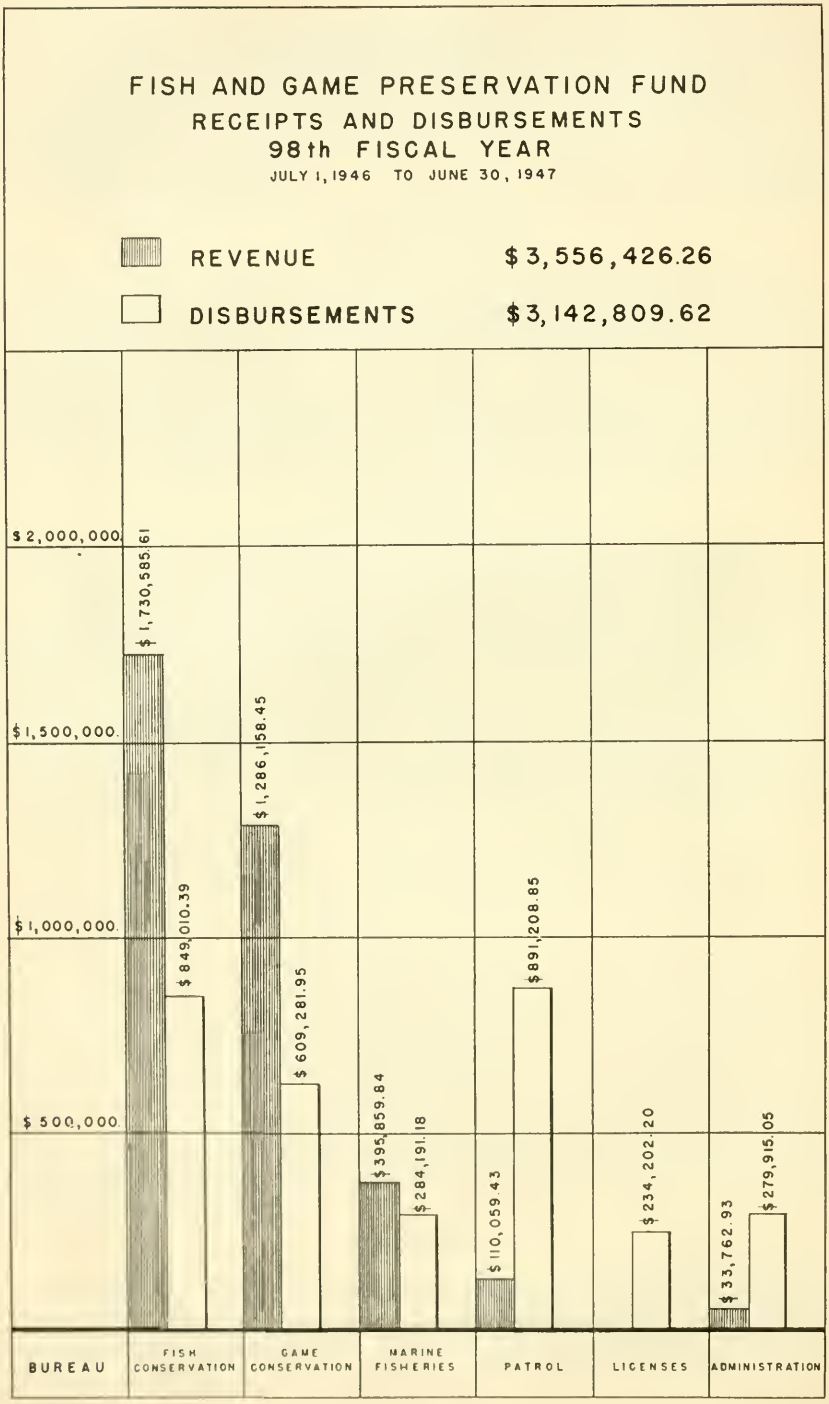

FISH AND GAME PRESERVATION FUND
RECEIPTS AND DISBURSEMENTS
98th FISCAL YEAR
JULY 1, 1946 TO JUNE 30, 1947
REVENUE $3,556,426.26
DISBURSEMENTS $3,142,809.62
$2,000,000.
$1,500,000.
$1,000,000.
$500,000.
$1,730,585.61
$849,010.39
$1,286,158.45
$609,281.95
$395,859.84
$284,191.18
$110,059.43
$891,208.85
$234,202.20
$33,762.93
$279,915.05
BUREAU
FISH CONSERVATION
GAME CONSERVATION
MARINE FISHERIES
PATROL
LICENSES
ADMINISTRATION

FIGURE 1

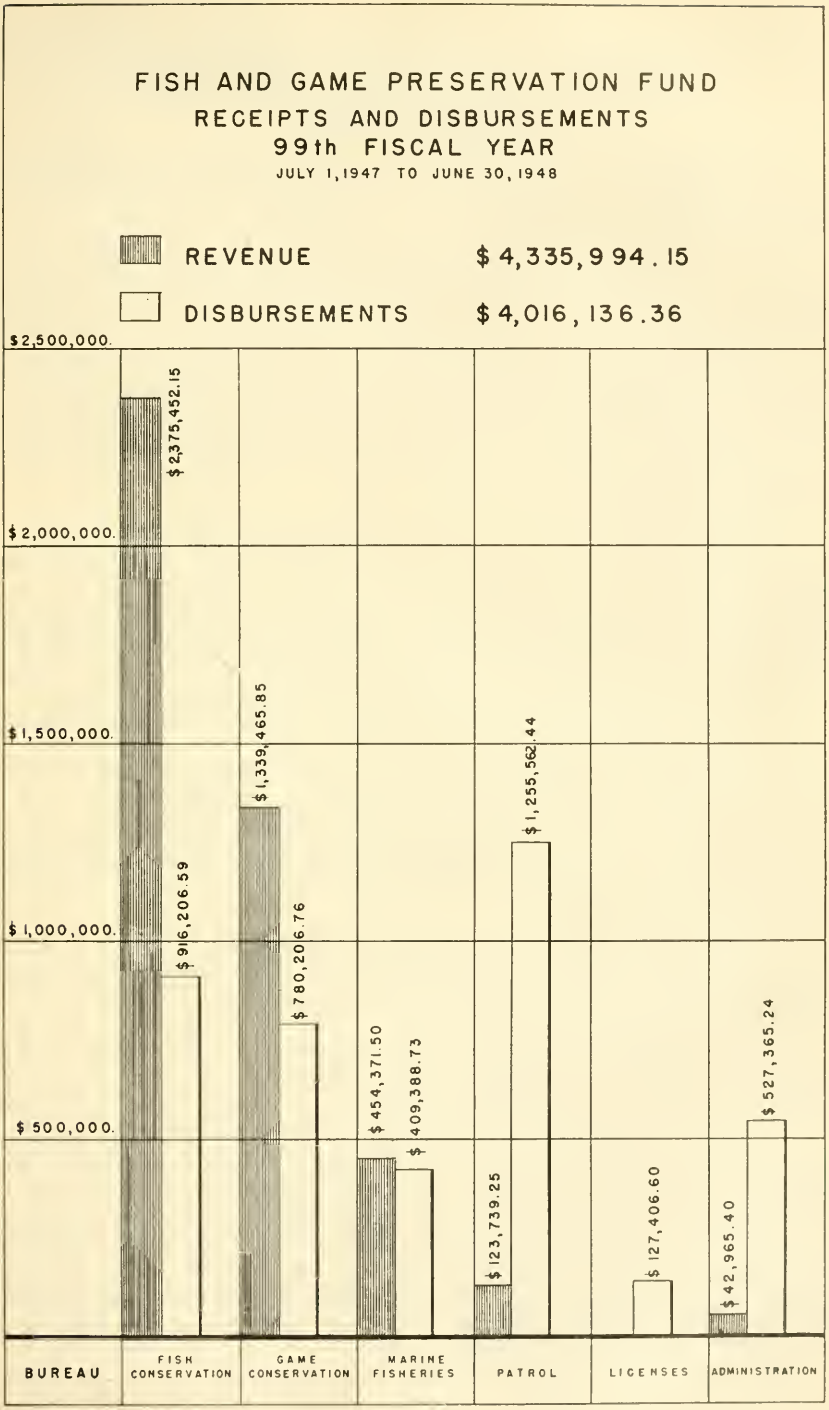

FISH AND GAME PRESERVATION FUND
RECEIPTS AND DISBURSEMENTS
99th FISCAL YEAR
JULY 1, 1947 TO JUNE 30, 1948
REVENUE $4,335,994.15
DISBURSEMENTS $4,016,136.36
$2,500,000.
$2,000,000.
$1,500,000.
$1,000,000.
$500,000.
$2,375,452.15
$916,206.59
$1,339,465.85
$780,206.76
$454,371.50
$409,388.73
$123,739.25
$1,255,562.44
$127,406.60
$42,965.40
$527,365.24
BUREAU
FISH CONSERVATION
GAME CONSERVATION
MARINE FISHERIES
PATROL
LICENSES
ADMINISTRATION

FIGURE 2

BUREAU OF PATROL AND LAW ENFORCEMENT

E. L. Macaulay was appointed Executive Officer of the Fish and Game Commission on May 10, 1948, and the writer assumed the duties of Chief of Patrol at that time.

The total number of arrests, convictions and fines in the present biennium have increased tremendously over that of the previous one. Arrests totaled 11,331, or an average of more than 15 per day, for the two-year period. Fines totaled $476,367, or an average of more than $42 per case. This represents nearly 100 percent increase over the previous biennium. All fish and game enforcement agencies of the Country have experienced similar increases in violations of the conservation laws. In California, a part of this can be attributed to an unprecedented increase in population (estimated for 1949 to be over 10,000,000), and from a historical standpoint, an aftermath of war.

No one is naive enough to believe that there will ever be a time when fish and game laws will be observed by the entire public without rigid enforcement. It is axiomatic that the laws of the Legislature, and the regulations of the commission are no stronger than their enforcement. This feature of conservation calls for expensive equipment, and with the advent of the five-day week, increased personnel to accomplish results.

The patrol areas of the State consist of the following:

1. The coastal area: Del Norte County to and including Monterey County; headquarters, San Francisco.

2. Northern California area: The Counties of Modoc, Lassen, Siskiyou, Shasta, Trinity and Tehama; headquarters, Redding.

3. Sacramento area includes all the counties in the Sacramento Valley, and Sierra Nevada Mountains from Tehama, Lassen, and Shasta Counties, south to and including El Dorado and Sacramento Counties; headquarters, Sacramento.

4. The San Joaquin area includes counties in the San Joaquin Valley and Sierra Nevada Mountains, south of El Dorado and Sacramento Counties to and including Kern County, but excluding Mono County; headquarters, Fresno.

5. The Southern California area includes San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside, San Bernardino, Inyo, and Mono Counties; headquarters, Los Angeles.

6. The marine area consists of the entire coast line from the Mexican border to the Oregon line, and the commercial fishing areas of the Sacramento, and the San Joaquin Rivers; headquarters, San Francisco.

Each of these areas is under the direct supervision of an assistant chief of patrol, and is further broken down into patrol captain districts. At the present time there are 16 captains and a total of 170 wardens and assistant wardens, as well as one warden-pilot. Thirty of the assistant wardens mentioned were placed on the pay roll on June 1, 1948, as a result of the five-day week requirement.

Two of the present patrol areas were created during the biennium just concluded; the Northern California area, and the San Joaquin

area. These were formerly a part of the Sacramento patrol district. Captain Jordan of Redding, and Captain Gilloon of Fresno, were promoted to fill the positions of assistant chief in these areas.

The following wardens were promoted to captains during the biennium:

Jay Cox—Alturas	Walter Shannon—Los Angeles
Ellis Berry—Tulare	Lee Shea—Santa Rosa
Willard Greenwald—La Mesa	Howard Shebley—Independence
Leslie Lahr—Eureka	A. L. Stager—Redding
Wm. La Marr—Altaville	

Following is the list of personnel retired during the biennium period:

Name	*Date of retirement*
Warden Fred Starr	July 31, 1946
Warden Earl Caldwell	October 31, 1946
Captain O. P. Brownlow	December 31, 1946
Warden E. H. Glidden	June 9, 1947
Warden F. A. Bullard	June 30, 1947
Captain Walter Engelke	June 30, 1947
Warden N. C. Kunkel	December 31, 1947
Warden Walter Emerick	March 31, 1948
Assistant Chief H. C. Jackson	June 30, 1948
Warden W. C. Malone	June 30, 1948

We are especially grieved to report the loss of Warden Walter Krukow who met his death in line of duty on April 2, 1947. He was shot near Redding by an irresponsible youth, whom he had reprimanded for a violation of the fishing laws. Warden K. Carl Lund was found dead from asphyxiation in a state car on June 14, 1948.

The wardens' school of instruction was inaugurated in this biennium; the first one being held at Wheeler's Hot Springs, Ventura County, in February and March, 1947, under the capable supervision and management of Assistant Chief of Patrol H. C. Jackson. Forty wardens and assistant wardens attended this school. The second and third schools were held at Asilomar, Monterey County, in January and June, 1948. A total of 73 attended these meetings. The results of these schools have proven most satisfactory, and will be continued. To the other bureaus of the division, attorneys, county and state agencies who contributed to the success of this program, the Bureau of Patrol extends sincere thanks.

The wardens reserve force now numbers 86, including the marine reserve patrol. These men have been unselfish with their time, in lending assistance to the regular patrol whenever requested. These groups are principally in Southern California, composed of sincere sportsmen, anxious to do their bit without regard to personal benefits in an effort to protect fish and game for all the people.

An effort has been made during this biennium to reequip the Marine Patrol. This branch suffered extreme depletion during the war. The following replacements, and additions have been made:

The patrol boat "Albacore" was purchased in March, 1948, and is being reconditioned for patrol work on the north coast. This hull was formerly a Coast Guard cutter, 83 feet in length. The gas engines have been removed, and it will now be powered with two 500 horsepower

FIGURE 3. Purchased in 1948 from Coast Guard surplus stocks, the speedy 83-foot M. V. "Albacore" is employed by the Bureau of Patrol in Pacific Ocean waters between Monterey and the Oregon state line. It is equipped with radar, radio-telephone, and other up-to-date marine equipment. Power is provided by twin 500 horsepower diesel engines. The second vessel to bear the name, the "Albacore's" home port is San Francisco

diesel engines. This vessel will have a complement of six men, and a cruising radius of 1,200 miles. It will be capable of remaining at sea for the longer period of time necessary in the patrol of ocean waters of the north coast. The bureau has been lacking in patrol of these waters for a number of years. This vessel will be in operation early in the fall of 1948.

Two 63-foot aircraft rescue vessels were purchased near the close of the biennium. These vessels will replace two of the 45-foot boats which have been in service since 1937, and which will be sold because of obsolescence. The fast 63-foot vessels are equipped with two 630-horsepower gas engines, radio and radar, and will be used principally in southern waters for policing closed areas. These boats have been named the "Bluefin" and the "Marlin."

The 26-foot twin engine patrol boat "Skipjack" was purchased in June, 1947, and is used for coast and harbor patrol on the south coast and Catalina Island.

Two small 23-foot Chris-Craft boats were purchased in June, 1947; one, the "Bass," was stationed at Millerton Lake and early this year transferred to the Sacramento River for patrol of that area; the other, the "Grunion," is stationed at San Pedro, and is used on pollution and other inshore patrol.

Considerable difficulty has been experienced in securing automotive equipment for field work, caused largely by the inability of the suppliers to make deliveries. Ten jeeps were purchased at the close of the fiscal year. Two were placed in charge of each assistant chief. Should this type of equipment prove satisfactory, additions will be requested in the next budget.

FIGURE 4. C-45 Beechcraft assigned to Bureau of Patrol and Law Enforcement (also used by other bureaus as required)

A Model C-45 Beechcraft twin engine airplane was purchased in April, 1948. This plane will be used by all bureaus to carry on aerial reconnaissance and observation. It will supplement the Fairchild single engine plane now in use.

The plan for the use of state radios has not been perfected at the time of this report. Considerable success has been achieved with them in the northern patrol area, particularly in Shasta, Siskiyou, Modoc and Lassen Counties. Sheriff's radios were installed, and maintained in most of the cars of wardens in the coastal area from Humboldt County to Monterey County.

The bureau wishes to extend its appreciation to the various courts, newspapers and periodicals throughout the State which have so generously supported the program of law enforcement. Five hundred dollar fines and numerous jail sentences are not unusual for violations of the Fish and Game Code.

It is a rule of the bureau that all reports of violations receive immediate attention. Our efforts will continue in cooperation with local authorities and conservationists in every way possible towards rendering fish and game law violations an expensive risk.

A recapitulation of the arrests, fines and seizures will be found in the appendix, on page 105.

REPORT OF THE BUREAU OF MARINE FISHERIES

The responsibility for the conservation and administration of the ocean fisheries of California is in the hands of the Bureau of Marine Fisheries. The bureau conducts biological and statistical studies of the marine sport and commercial fisheries; and with the information thus gathered and analyzed, is able to make recommendations to the Fish and Game Commission and the Legislature for wise conservation measures.

In order to maintain an ever-expanding fishery which is exploiting an ever-shrinking resource, the bureau's research efforts have been redoubled, and our staff is constantly seeking the answers to the perplexing problems of changing abundance. With the return of many staff members, and the research vessel from war service, and with the addition of new research men, we are now able to carry on our program on something like the scale that the demands of the fishery require.

California's ocean commercial and sport fisheries still lead those of all the other states. While the sport fishery increased by leaps and bounds following wartime curtailment, the commercial fishery declined considerably in volume during the biennium. However, the value in dollars continued to rise.

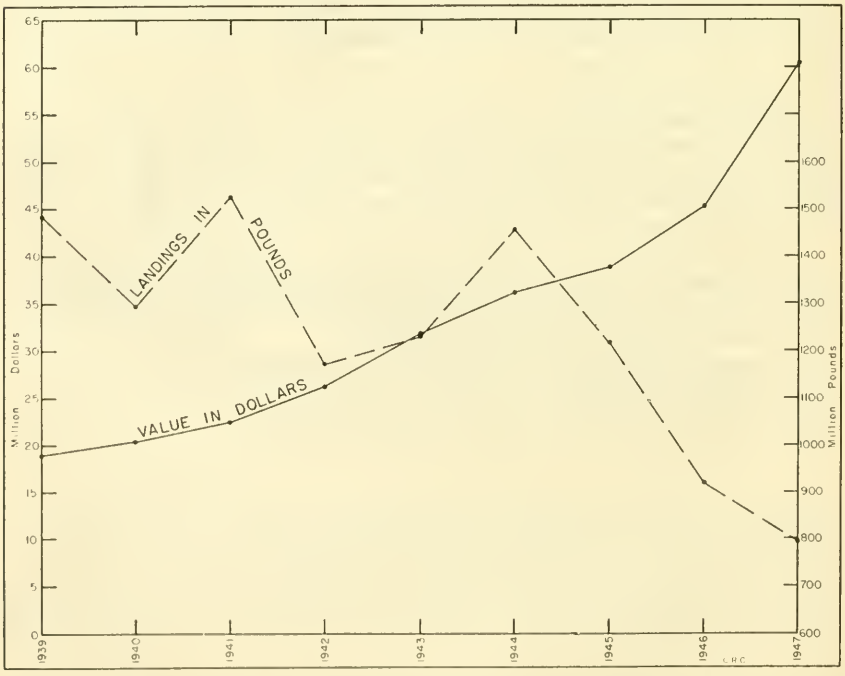


FIGURE 5. Value and poundage of California commercial fish catch, 1939-1947. Value represents amount paid to the fishermen at time of delivery. Note how values have continued to increase while catches have dropped

The total commercial catch dropped in 1946, and tumbled further in 1947 (see Figure 5). The decline was due almost entirely to the collapse of the sardine industry. With an expanded fleet fishing intensively, catches dropped because of lowered abundance of the sardines. The demand for this fish for canning was better than ever, and most of the fish was canned. Prices for oil and meal were low, and there was little inducement for the reduction industry, even if sardines had been available. By contrast, the tuna industry continued to expand, and catches reached record proportions. The mackerel fishery showed good gains, with the jack mackerel replacing the Pacific mackerel in a sensational rise. Anchovy and squid catches increased markedly as canners sought to augment slim sardine landings. The salmon fishery continued in a healthy condition, and catches of bottom fishes remained on a high level. (See Table 2.)

A general increase in the prices paid to the fishermen for all species of fish, plus the increase in landings of high-priced tuna, resulted in a continued rise in value of our fisheries. (See Figures 5 and 6.) Value records of $36,000,000 and $39,000,000 set in 1944 and 1945, and at the time deemed impressive, were left far behind as 1946 saw catches valued at $45,000,000 brought into California ports. This figure was in turn eclipsed by the tremendous valuation of $60,000,000 for 1947 catches. Of this amount, the yellowfin tuna alone accounted for $23,000,000. (See Table 2.)

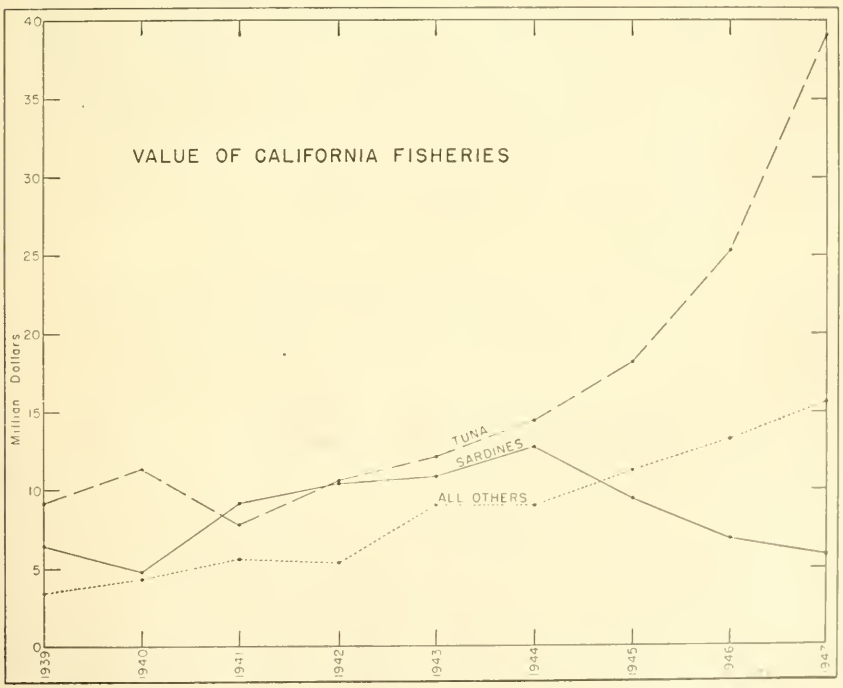


FIGURE 6. Value of California's two leading fisheries, compared to all others. Tuna includes albacore, yellowfin, bluefin, skipjack, and bonito. The great rise in total value shown in the chart on Figure 5 is accounted for in great measure by the tuna fishery. Because of increased prices, the decline in the value of the sardine fishery is not nearly so great as the drop in tonnage

Production of canned fish reached record proportions during the biennium, showing a considerable gain over the previous two years. The 10,000,000-case pack of 1947 was a notable figure, considering the light sardine catch. Production of fish meal and oil took a great drop because of the failure of the sardine fishery.

Accompanying the increase in value of the fish to the fishermen was a comparable increase in the value of the processed product. The sensational gain in wholesale value from $79,000,000 in 1945 to $132,000,000 in 1947 was due to the increase in the high-priced tuna pack and to the inflated prices that all canned fish are commanding. The fishing industry of California has truly become a multi-million dollar business.

The 1947 catch was made by 12,894 commercial fishermen, and was processed by 13,161 plant workers. The number of fishermen increased steadily from 10,871 in 1944-45 to 12,894 in 1947-48 (see Tables 3 and 4). This increase was accounted for entirely by United States born fishermen, as the number of foreign-born fishers remained constant. As a matter of fact, Norwegian-born fishermen have numbered exactly 454 for the last three years.

SARDINE

The sardine fishery suffered a severe collapse during the biennium. The 1946-47 catch was approximately half that of the previous season which was the lowest on record since the expansion of the fishery. In spite of the industry's hopes that the slump was temporary, the 1947-48 season brought a further drop, to the insignificant figure of 115,000 tons (see Figure 7). The effect of this decline was catastrophic to fishermen, boat owners, plant owners, and cannery workers alike. In despera-

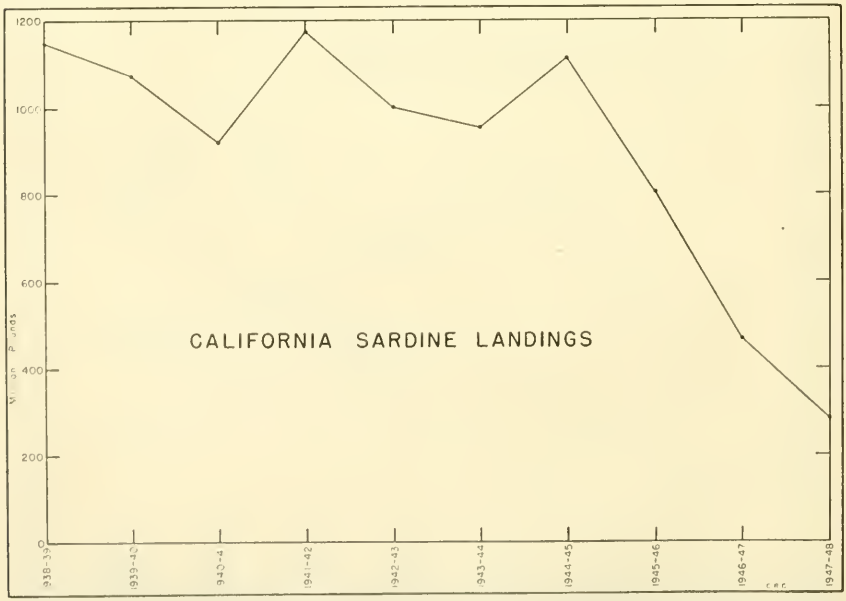


FIGURE 7. Tons of sardines landed at all California ports during the past 10 seasons. The total for 1938-39 includes deliveries to the floating plants. After this season the floaters ceased operations. The decline of the sardine fishery has been little short of catastrophic

tion, the industry turned to every available species of fish that could be canned, and record-breaking packs of jack mackerel, herring, anchovies, and squid were produced. Expanded exploitation of these species has constituted an additional threat to their future abundance.

During both seasons the fisheries at San Francisco and Monterey failed almost completely. Virtually the entire purse seine fleet deserted the fishless northern waters, and concentrated their activities in Southern California. As a consequence, landings were heavy at San Pedro in 1946-47, but even the tremendous fishing effort could not maintain the catch the following year. Trial shipments of sardines by truck were made from Southern California ports to Monterey in 1946-47. Considerable tonnages were trucked the following season, some as far as San Francisco. Most of the fish arrived in good condition for canning. Extremely high prices for canned fish made this expensive procedure possible, and kept the Monterey canneries from closing.

Practically all the fish taken during the last two seasons were used for canning. The high price of the raw fish, and low prices prevailing for oil and meal, coupled with the scarcity of fish, made the operation of reduction plants unprofitable. Production of sardine meal dropped from 31,000 tons in 1946-47 to 13,500 tons in 1947-48. At the same time, sardine oil production declined from 4,100,000 gallons to 1,700,000.

Because of the major crisis experienced by the sardine fishery, much of the effort of the research staff was directed toward explaining the reasons for the failure to the industry, and toward finding ways in which to rehabilitate the sardine population and prevent further collapse.

Results of the investigations extending over 30 years were summarized and distributed in mimeograph form. These studies showed that the sardine fishery could not continue to expand, and that peak production had been reached by 1937. Stated briefly, the reasons for decline are a drop in abundance brought about by extremely heavy fishing, accompanied by a succession of many seasons of very poor spawning. Although this information had been published several years earlier, and had been repeated regularly, most of the industry was not prepared for the disaster.

Leaders in the industry realized, however, that if the fishery were to be rehabilitated, expanded research beyond the facilities of the Bureau of Marine Fisheries would be necessary. Through their efforts, additional funds were made available to other agencies, by the Legislature, and much time and effort has been expended in coordinating the work of the bureau with that of The Scripps Institution of Oceanography, the California Academy of Sciences and the United States Fish and Wildlife Service. By the end of the biennium, a well-organized program had been set up under the guidance of the newly-authorized Marine Research Committee which is composed of members of the industry as well as of the Fish and Game Commission. The expanded work will concentrate on the collection of physical, chemical, and biological data at sea, and the subsequent analysis of this oceanographic information. In addition to the studies to be carried out by these agencies, the Bureau of Marine Fisheries acquired a second research vessel which will spend the major part of her time on this oceanographic work.

Routine sardine investigations were continued throughout the biennium. These comprise analyses of the size and age composition of the catch, and a measure of the average catch of the fishing fleet. For all of California, the monthly catch of an average vessel in 1946-47 was 50 percent below that of the previous season, and in 1947-48 again dropped almost 50 percent below 1946-47. The greatest decline occurred off San Francisco where fish were so scarce the fleet could no longer operate. At Monterey the decline was almost 80 percent in 1946-47, and in 1947-48 not enough boats were fishing to permit calculations of an average. Fishing in Southern California was relatively successful, but there also the average monthly catch in 1946-47 was only 65 percent of the previous season, and in 1947-48 dropped to 45 percent.

Not only did the tonnage landed by the fishermen decline, but the larger fish became less and less abundant on the fishing grounds. This was a continuation of a trend which has been going on for some years. In the early history of the fishery, sardines as old as 15 years were frequently taken, and the industry depended largely on fish of four to 10 years. In the past two seasons fish of five years and older comprised only about 5 percent of the total, and over 65 percent were one and two year-olds. The results of the age composition studies carried on in cooperation with the U. S. Fish and Wildlife Service have been summarized and published in Fish Bulletin 69.

The M. V. "N. B. Scofield" made one trip into Mexican waters in March and April of 1948 to check reports that sardines were abundant south of the usual fishing grounds. Waters were surveyed as far south as San Domingo Point. No great abundance of fish was found north of Point San Eugenio. Former studies and tagging experiments have indicated that sardines from these northern Mexican waters mingle with the California population. A greater abundance of sardines was observed southward between Point San Eugenio and San Domingo Point. Counts of the vertebrae of fish collected in this area confirm former studies that this more southern sardine population makes little if any contribution to the California fishery.

Realizing that some sort of regulation would be necessary if the sardine fishery were ever to recover, the industry chose a Sardine Industry Advisory Committee to work with the bureau and advise the Fish and Game Commission. Two objectives were set up: A temporary program of regulation for the 1948-49 season within the framework of existing legislation; and a long-range legislative program of conservation. Real progress was made in reconciling divergent ideas, and the temporary program embodying a size limit and a limitation in the number of fishing days was presented to the commission and adopted immediately following the close of the biennium. Work on the legislative program is continuing, with most of the industry now aware of the uncertain future, and realizing that only by taking drastic measures can the fishery survive.

In view of the expanded fisheries for anchovies and herring, the sardine staff extended their work to include the collection of length measurements and scale samples from these two species. This constitutes a start toward life-history and abundance studies.

TUNA

The period covered by this report was one of reconversion and expansion in the tuna industry. With the decline in the sardine fishery, and a tremendously expanded market for canned tuna, the attention of the industry at the close of the war appeared to concentrate upon the possibilities for an enlarged tuna fishery. The increase in the price of tuna, and the success of the residual fleet of tuna boats attracted new and additional capital into the fishery. A large fleet of new vessels was built or under construction, existing canning plants were expanded, and several new ones were organized. In 1941 there were 17 plants that packed tuna in California. By June, 1948, the number had increased to 23. In

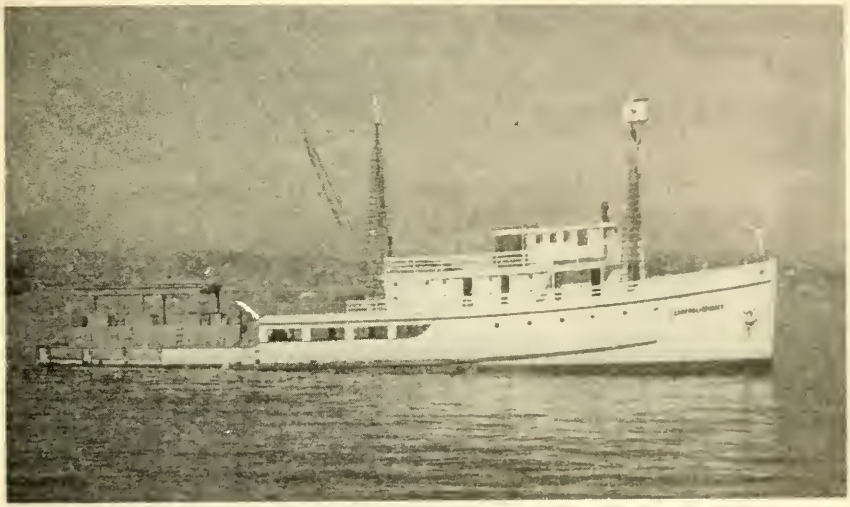


FIGURE 8. Tuna bait boat returning to San Diego with a load of fish.
Photograph courtesy of "Tuna Fisherman"

1941 a relatively stable fleet of 96 tuna boats, aggregating about 19,333 gross tons, fished with live bait throughout the year or a greater part of it. By the end of 1946 (latest figures available at writing), this number had increased to 136 vessels, aggregating 27,526 gross tons; and the totals have increased steadily as the regular tuna boats, relinquished by the Navy, have been reconverted to commercial fishing, and new clippers have been built. Moreover, the failure of the sardine fishery in this biennium has forced a large number of purse-seiners to seek other employment. The majority of these have turned to tuna, with the consequence that this has materially increased the total tonnage of vessels engaged in the tuna fishery.

The keen competition for tuna between vessels and between fleets has resulted in a number of important developments. For the first time the supremacy of the California industry has been challenged by the Pacific Northwest. Originally interested only in the local seasonal run of albacore in the vicinity of the Columbia River, the plants there which

were constructed or modified to pack albacore are now aggressively reaching out for their share of yellowfin tuna, and skipjack. In 1947 one company sent its mother-ship into Costa Rican waters, and in the spring and summer of 1947 purchased on the grounds for delivery to Astoria a full load of yellowfin and skipjack. In the winter of 1948 a second northern company had two mother-ships on the grounds purchasing fish from our fleet for delivery to the Columbia River.

In self-defense, a number of California packers have followed this lead; and by the summer of 1948 a number of tenders, or mother-ships, were either in actual operation, or in process of conversion. The mother-ships have apparently come to stay; and this marks an important development initiated in this period.

The purse seiners, which in earlier years fished for yellowfin and skipjack only in Lower California waters in that season when fish were there available, have now by force of circumstances already mentioned, extended their operations as far as Costa Rica. This has necessitated enlarged refrigeration plants on the vessels, and some modification in equipment. The extended range in operations has also resulted in the construction—or conversion—of a number of large vessels for purse-seining. For the first time the largest purse seiners are now comparable in size and tonnage with the large live-bait tuna boats.

FIGURE 9. A California purse seine boat leaving port. This type of vessel, of which there are over 200 in California, fishes for sardines, tuna, and mackerel principally. (*Photograph by Vernon M. Haden, San Pedro*)

This expansion in purse seine operations has resulted in considerable friction between the two basic types of gear; and their respective

associations are now exerting considerable pressure upon Central American governments to relax or restrict the fishing regulations in their favor.

Reflecting the competition between boats, and the increasing difficulty of securing full fares, a few vessels are now carrying scout planes. This is still in an experimental phase, and the results are somewhat conflicting. Although the planes have definitely increased the scouting range of the individual vessels, and have materially aided in locating bait, at least two boats have tried and abandoned the carrying of a plane. At least one boat has continued to operate its plane over a number of trips, and is thoroughly satisfied with the results. Others are noncommittal. In all probability, the planes will come into limited use.

During this period of expansion, the landings of yellowfin tuna broke all records with receipts of 150,000,000 pounds in 1947 (see Figure 10, and Table 5). Skipjack catches were well above average, but still slightly below the peak reached in 1940. The bluefin fishery, conducted in local and northern Mexican waters, continued at a level slightly

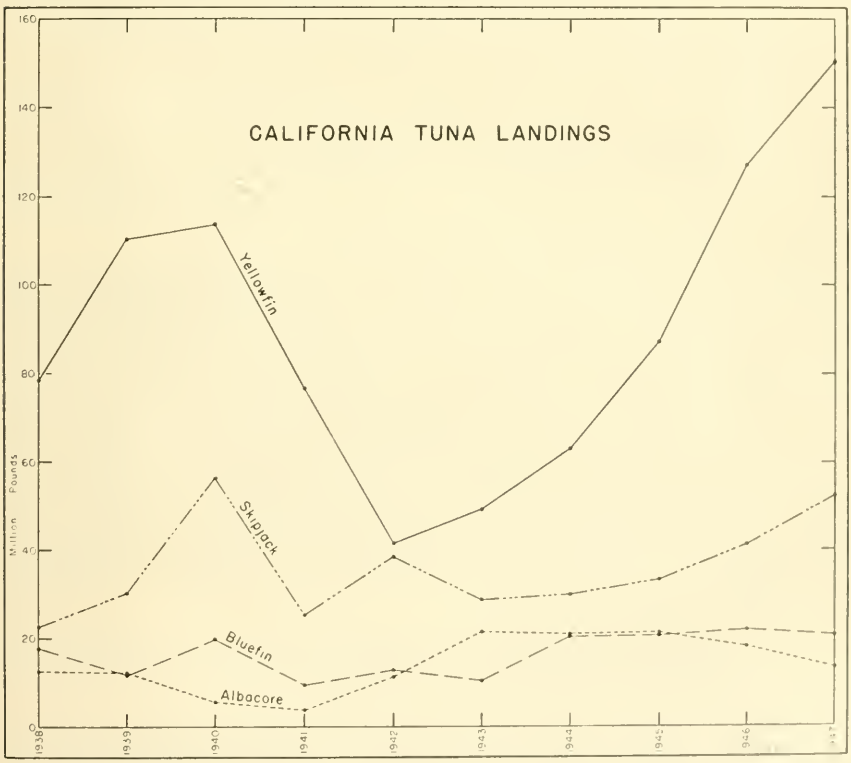


FIGURE 10. California landings of yellowfin, skipjack, albacore, and bluefin tuna, 1938-1947. Catches made by California boats and shipments from Oregon, Washington, and Latin America are included. Shipments from Japan are excluded. The tuna fishery has recovered from the slump caused by wartime restrictions and diversion of vessels to military service. The yellowfin tuna is now the most valuable species taken by the California fishing industry

above average. During 1946 and 1947 albacore slumped somewhat below the preceding three seasons. The fifth species of tuna-like fish, bonito,

underwent an exceptional increase to parallel the expansion in purse seine operations. Bonito landings increased from less than 1,000,000 pounds in 1944 to over 13,000,000 in 1947 (see Table 5).

The picture outlined above intimates that the tuna fishery faces a period of intensive exploitation. The future of the local industry depends entirely upon the size of the available stocks of tuna. If these stocks are extensive and relatively untapped, then a healthy expansion is possible. If, on the contrary, the stocks are limited in extent, and already heavily fished, then further expansion is not warranted, and may precipitate hardship and even disaster.

The staff of the bureau foresaw this crisis; and the entire investigative program was originally designed to answer this major question. Unfortunately, the war brought the tuna investigation to a standstill, and it was not resumed until the summer of 1946.

Four species contribute to the pack of "tuna." Of these, the bluefin tuna and the albacore are temperate and seasonal fisheries. Because they are seasonal, the catch of either species is determined by the extent to which they enter our fishing area, their abundance at that season, and the length of time they remain available. Over an 11-year period, the combined catch of these two species has averaged less than 15 percent of the total take of tuna. The remaining 85 percent has been supplied by the other two species, namely, the sub-tropical and tropical yellowfin tuna and skipjack. On the average the yellowfin supplies about 62 percent and the skipjack 23 percent of the total catch of tuna. Because of this fact, the laboratory investigations concern primarily the yellowfin and skipjack, with the emphasis upon the former.

In order to determine the potential catch of yellowfin tuna, it is necessary to know the extent of the stock supplying that catch. The work interrupted by the war has been resumed, and it has been shown tentatively in this biennium that the stock of yellowfin exploited by our fleet is confined to the eastern Pacific, and is not replenished from the Central Pacific Basin. Moreover, there are strong suggestions in as yet uncompleted work that the catch per boat has already passed its peak. The indications are, therefore, that the stock of yellowfin now exploited by our fleet will not support indefinitely any appreciable further expansion. The main emphasis of the entire tuna investigation is, therefore, concentrating upon an attempt to substantiate these indications, and determine definitely at what level the yellowfin fishery should be stabilized. If the pack of tuna is to be substantially and permanently increased, it must be at the expense of either:

(1) A distinct and more distant stock of yellowfin and skipjack, or
(2) The bluefin and albacore populations.

Before the latter alternative can be accomplished, it will obviously be necessary to locate these two species in those seasons when they are not now available in our fishing areas. So the secondary and minor phase of the tuna investigation consists now of exploratory work for bluefin and albacore, and a determination of the extent of their populations. In order to investigate vertical as well as horizontal extent, a set of drift gill nets of varying mesh was ordered and delivered at the close of this biennium; and the exploratory work has since begun.

MACKEREL

In an effort to offset the failure of the sardine fishery, the purse seine fleet intensified its effort on mackerel. Although the scoop boat fishery for Pacific mackerel was generally unsuccessful in 1947, the operations of the seiners maintained the catch of this species at a fair level. However, indications are that the Pacific mackerel fishery is in poor shape. During the 1947-48 season much of the catch consisted of fish spawned in the spring of 1947.

The feature of the mackerel fishery was the tremendous increase in the catch of jack mackerel (horse mackerel). The 1946 landings of 15,000,000 pounds were well above average, but 1947 catches reached the unprecedented figure of 129,000,000 pounds (see Figure 11). Some of this catch was made in Central California, but the bulk of it resulted from the concentration of purse seiners in Southern California. In actual practice, the fleet fished for jack mackerel, sardines, and Pacific mackerel indiscriminately, taking whichever they could find. In fact, the schools were usually mixed, many hauls including all three species.

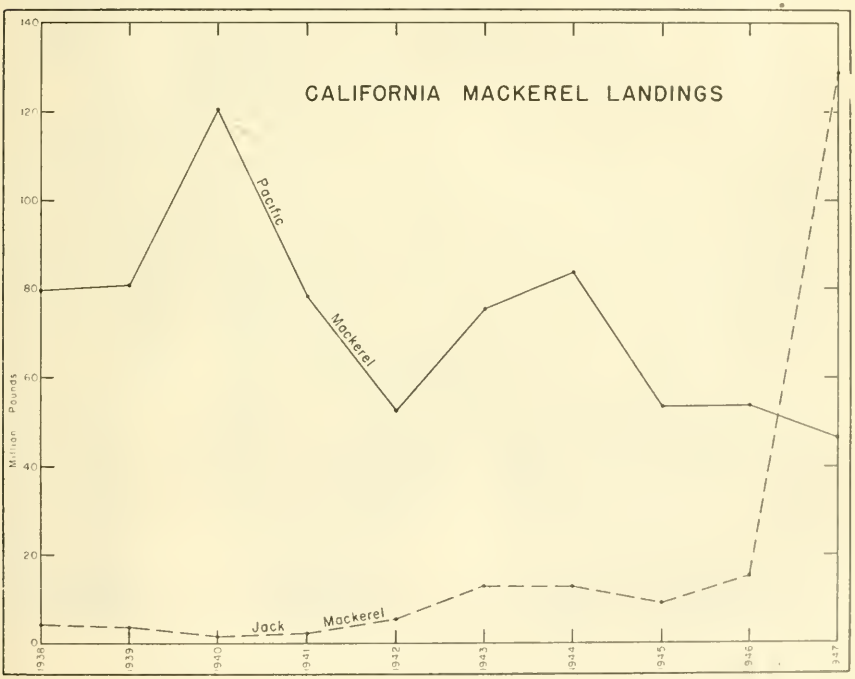


FIGURE 11. California landings of Pacific mackerel and jack mackerel, from 1938 through 1947. While the catches of Pacific mackerel have declined during the last several years, the once unimportant jack mackerel has achieved a leading position among California fisheries

Considerable quantities of both species of mackerel were shipped from the south to Monterey for canning during the 1947-48 season.

Young jack mackerel were very numerous, and the catches contained a high proportion of fish hatched only a few months previously. In order to afford some protection to these baby fish, as well as to young

Pacific mackerel and sardines, the commission set minimum size limits for all three species, effective in December, 1947.

During the biennium our research work on Pacific mackerel centered on studies interrupted by the war, and on routine sampling of the commercial catch at Los Angeles Harbor and at Newport Beach. The sampling program included both measurement of fish, and the collection of otoliths (bony ear structures) for use in age determination. Age studies progressed satisfactorily. Otoliths collected were read as was part of the backlog accumulated during the war. Results of the tagging and racial studies were analyzed and compiled in manuscript form. In both cases, the field work was done before the war. These studies indicated that the Southern California fishery draws to some extent on the mackerel population from as far south as central Lower California, but that fish from southern Lower California and the Gulf of California in all probability contribute little or nothing to the fishery. Tag returns demonstrated a free movement of fish between northern Lower California, Southern California, and Central California. Toward the close of the biennium work was started on an analysis of scoop boat catches to cover the years since 1939.

The great increase in importance of the jack mackerel lead to the establishment of a limited study of this species in 1947. The official name of the fish was changed from "horse mackerel" in the summer of 1947 because the old name proved a handicap in disposing of the increased pack. Before making the change, each processor was asked to show his preference for one of several acceptable substitute names. The consensus favored jack mackerel, and it was given official sanction.

Studies in progress at the close of the biennium included sampling of the commercial catch, age determinations, and a population study. Scales of jack mackerel did not prove satisfactory in age work, so otoliths (collected as part of the sampling program) are being used with apparent success.

SALMON

The salmon resource was first developed as a commercial fishery under the Mexican Government, and before that time had been important in the food economy of many Indian tribes. This fishery is today the most important in Northern California; and in the light of the discoveries of the last two years, it must be recognized that its latent value has not yet been realized.

The 1946 catch of 13,639,000 pounds slightly exceeded that of 1945, and was the largest of which there is a reliable record. The following year, 1947, saw the production of 11,428,000 pounds, a catch that is among largest of which we know (see Figure 13).

The bureau's salmon tagging program of the past biennium has given for the first time two independent measures of the total run into the Sacramento-San Joaquin River system. These measurements indicate that the run of king salmon is far larger than had been supposed. They also indicate that the catch-to-run ratio is smaller than for any other major stream for which records have been published. These figures, when compared with those of the runs in other rivers, indicate that the potential values have been but partially developed.

FIGURE 12. Tagging a salmon. One man holds the fish in the V-shaped padded trough. The other applies a pair of tags. The tags are plastic discs, held in place by a pin or wire which passes through the flesh at the base of the dorsal fin. Tagging at sea, in the delta region, and in the streams gives measures of the sizes of the runs and the importance of the various rivers, movements in the ocean, and the time that runs bound for different streams pass through the fishing grounds. (*Photograph by D. H. Fry, Jr., Stanislaus River near Oakdale, November, 1947*)

In the last two years every stream of the Sacramento-San Joaquin Valleys which is without a barrier to the migration of the adults or a serious hazard to the life of the young salmon has had runs that crowded the spawning areas.

The future of this fishery is threatened by a reckless water program which, however, can be turned to the advantage of the salmon without taking water from any of the other benefits such as irrigation, flood control, power development, and salinity control. The water plan for the Sacramento-San Joaquin Valley has so far failed to recognize the fact that the flow of water required either for the control of salinity to

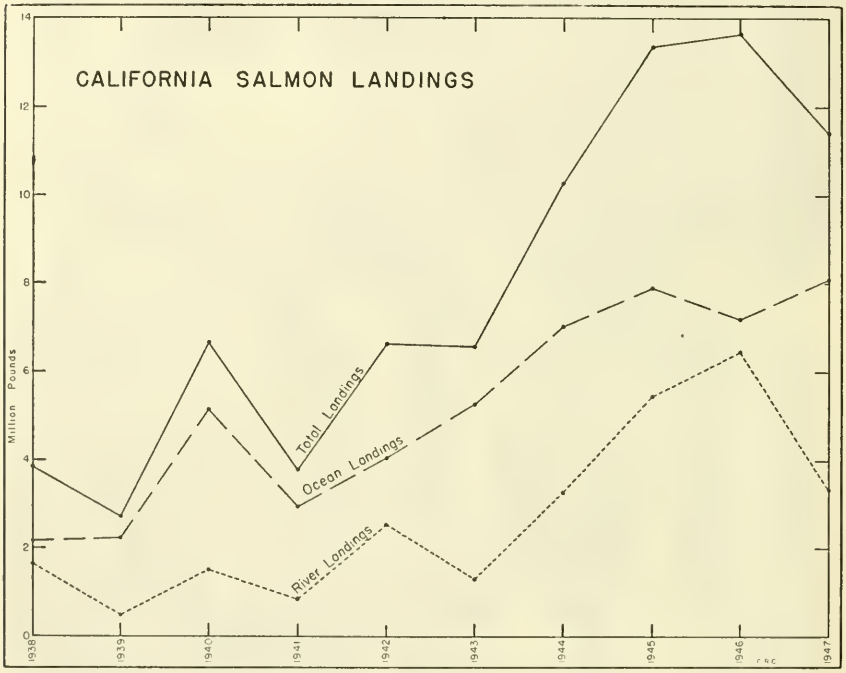


FIGURE 13. Commercial landings of salmon in California, 1938-1947. River catches, made in the lower reaches of the Sacramento-San Joaquin Rivers, consist of king salmon, exclusively. The ocean fishery, conducted from the Oregon line south to Monterey Bay, takes king salmon principally, but some silver salmon is also included in the catch

protect the rich lowlands, or for irrigation use below the elevation of the spawning areas is more than enough to provide adequate water for the salmon if it were properly distributed among the salmon rivers. That the water to control salinity is being taken from one or two rivers only instead of being shared among all of them is a serious flaw in the water plan that must be corrected if the fishery is not to suffer.

The spawning areas have been limited in size by high dams and the reduced flow in their streams, but they may be enlarged and improved where the rivers run through rockpiles of dredge tailings by making of them natural hatcheries in artificial channels which would make for a more efficient use of the available water.

The king salmon resource can be increased by erecting suitable fish ladders over those low dams which now prevent the access of the salmon to the spawning areas above, by cleaning up the pollution spots that stop the migrations of both the adults and the young, and by screening the diversions that trap and kill young on their way to the sea.

During the biennium, considerable progress has been made in the construction of fishways and screens in the Central Valley, but much remains to be done. We have developed a screen and ladder unit which works in close cooperation with the Division of Architecture.

The most notable achievement of the past several years was construction of a new fishway at Woodbridge Dam on the Mokelumne River. This stream has been suffering from the effects of a serious fish block at the dam. The old ladder was too small and too steep, was poorly located, and could not be reached by the fish during periods of low flows. When the flashboards were removed from the dam, the old fish ladder was totally inoperative, and at low flows the dam was impassable. Because of this situation, the salmon run is badly depleted. In early 1948 the new fishway was completed (see Figure 14). This ladder has two branches, one for use when the flashboards are in place, the other for when the boards are out. The structure was designed and the work supervised by the Department of Public Works, Division of Architecture. Their engineers can well be proud of the result. The fall of 1948 will be the first chance salmon will have to use the new ladder. Rehabilitation of the run can be expected in the next few years.

In late 1946 a fishway was completed over Clough Dam on Mill Creek. This ladder has since functioned well, and should result in benefit to the salmon and steelhead runs in this important tributary of the Sacramento River.

Preliminary plans have been drawn for critical fish ladders for Daguerre Point Dam on the Yuba River, and Sutter-Butte Dam on the Feather River. Early construction of these fishways is of vital importance. As the biennium ended, work was about to start on a series of small fishways over several gravel dams on the Merced River.

A large fish screen on Deer Creek was completely rebuilt, and a by-pass was constructed. Work is about to start on the rehabilitation of other screens and construction of by-passes on this stream and Mill Creek.

Because it may be possible to substitute electric fish screens for mechanical screens, and thus effect a great reduction in cost, we have continued our experiments with these devices. In theory, electric screens divert the migrating young salmon away from canal headings by shocking them with a harmless but painful discharge of electricity. To date the experiments have been disappointing. Some extensive changes in the electrode system gave some promise when tried on a small scale, but failed when applied to an entire screen. One difficulty has to do with getting the young salmon far enough from the canal so that the current of the river will take them on their way down the channel. Because most of the downstream migration takes place at night, and because young salmon are attracted by light, it was decided to erect a series of moving lights to attract the fish as they approached the screen. The lights would then lead them downstream to a place of safety. The device, tried on a large screen, has given definite promise; but biological, mechanical, and electrical

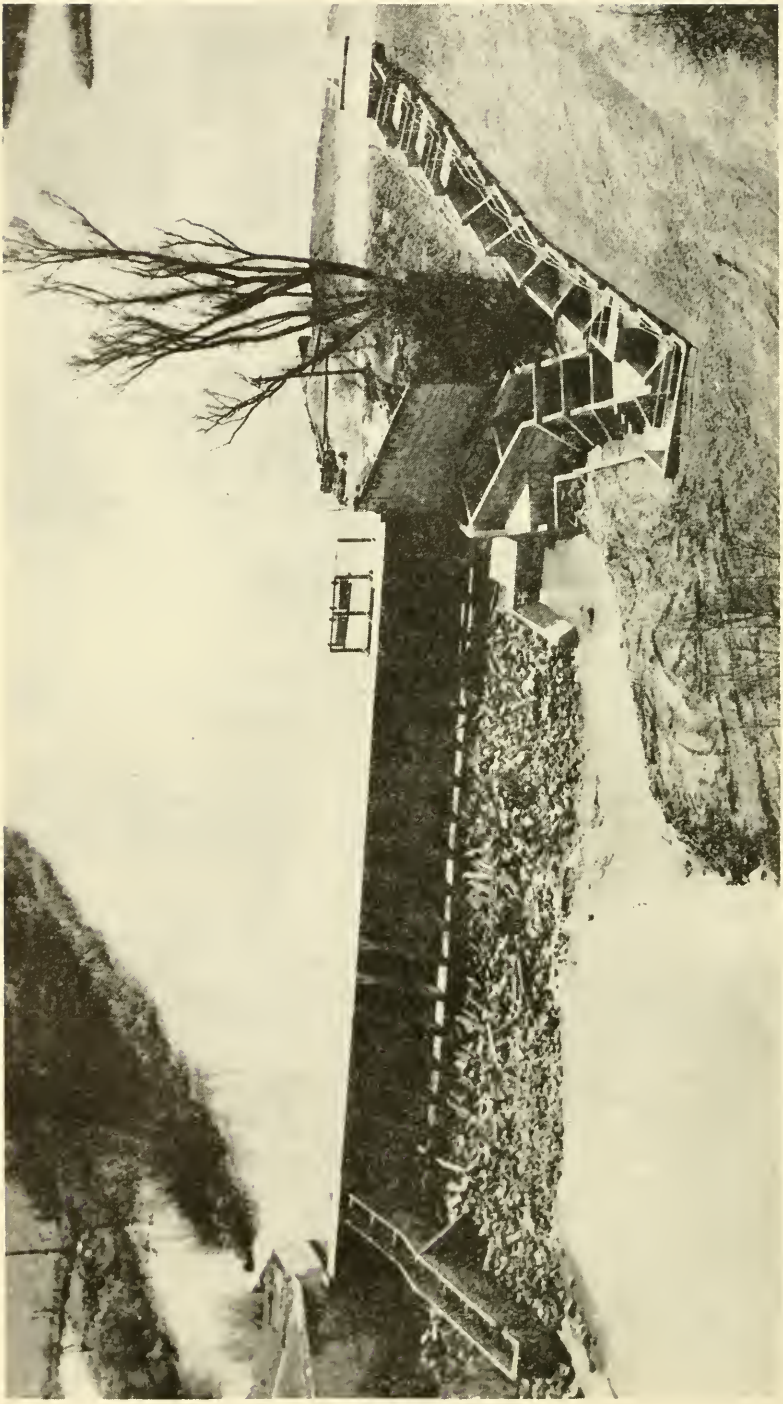


FIGURE 14. Woodbridge Dam on the Mokelumne River near Lodi. The new fishway, completed in February, 1948, is shown at the right. When the flashboards are in place and the lake is high, the salmon ascend the higher ladder at the extreme right. The alternate route which doubles back to the base of the dam abutment is used when the boards are removed. The old ladder, which was virtually useless, appears at the left. *Photograph by D. H. Fry, Jr.*

problems remain to be solved before it can be considered a complete success.

The most gratifying trend in connection with the fight against pollution is the growing awareness on the part of the public that the State cannot afford to let its streams become open sewers. Only with the support of aroused public opinion can the evils of pollution be corrected. Because of this attitude, offending industries and municipalities are now taking steps to clean up our waters.

Every year since 1944 the early part of the fall salmon run in the Tuolumne River has been blocked by pollution from the City of Modesto, and various industries in and near Modesto. In 1947 the situation was so bad and so little progress had been made that at the request of the Division of Fish and Game the Attorney General brought suit against the city and the industries. As in 1944, 1945, and 1946, the temporary expedient used was to release water from Don Pedro Dam to dilute the pollution to the point where salmon could live and proceed upstream. The court granted a delay in reaching a permanent solution. The city has been making a sincere effort to finish an adequate treatment plant before the fall run of 1948, but it seems probable that the plant will not be ready for the first part of the season, and that a release of water will be needed in 1948.

Pollution at Riverbank on the Stanislaus River caught us off guard, and killed the early part of the fall run in 1947. Because better use was made of the inadequate disposal system at Riverbank, the remainder of the season passed with no further trouble. By rejuvenating this system, the city and industries will probably be able to get through the fall of 1948, but an entirely new series of disposal beds will have to be put in service in the near future.

During the biennium, the salmon runs were satisfactory in all the major spawning streams of the Central Valley except the Mokelumne and San Joaquin Rivers. For example, the combined spring and fall runs of 1946 in the American River were estimated by tagging at 39,000 fish, of which 1,700 passed Folsom Dam. The U. S. Fish and Wildlife Service counted 57,000 salmon in the Tuolumne River in 1946, and estimate that in addition about 4,000 fish jumped the dam and were not counted. The calculated run in the Stanislaus River in 1947 was 13,000 fish. The Mokelumne River run has dwindled because of an inadequate fishway, but this condition has been corrected, as reported above.

The situation on the San Joaquin River could not be worse than it is. Inadequate water releases from Friant Dam have resulted in near extinction of the salmon run. The winter of 1946-47 was relatively dry, and the U. S. Bureau of Reclamation felt that it could allot no more than 15,000 acre-feet of water for the spring run. This water was released in such manner as to be of maximum benefit, but was still so inadequate as to be disastrous. Flows of 100 to 130 second-feet are inadequate during hot weather. Only 6,000 salmon were counted past Mendota Dam in 1947, compared to 56,000 in 1945, and 30,000 in 1946.

The winter of 1947-48 started as one of the driest on record. The U. S. Bureau of Reclamation announced that no water whatsoever could be spared for salmon; and in spite of all our efforts, as well as those of sportsmen's groups, the fishing industry, and congressmen to obtain water, the river below Dos Palos remained dry during the time of the 1948 run. As

the only recourse available, the Bureau of Marine Fisheries operated a salvage plan which called for construction of a fish trap, hauling the salmon overland, and releasing them in a canal whence they could make their way to the spawning areas. Tank trucks were furnished by the Bureau of Reclamation. The trap was located at the mouth of the Merced River. The only fish to reach the spawning beds on the San Joaquin were the 1,955 that were transported by truck. Heavy rains in April and May caused the Merced River to flood, and on May 28 the trap was lifted to allow all the fish to ascend this stream. Previously, 163 salmon had been trucked up the Merced, as these floods were not anticipated. No water was released in the San Joaquin, and those fish that did not ascend the Merced were lost in the warm backwaters of the San Joaquin. At the same time most of the young downstream migrants also perished for want of water.

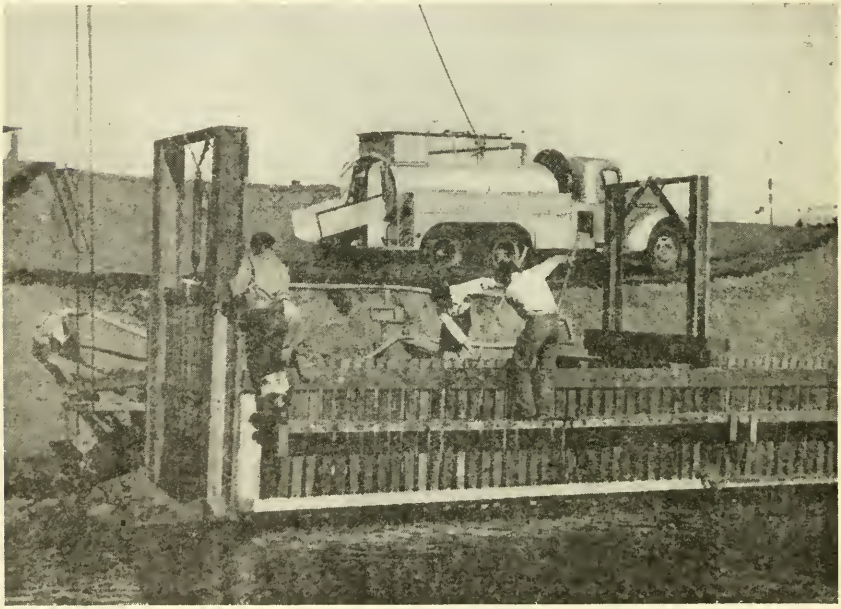


FIGURE 15. Because the middle reaches of the San Joaquin River were dry during the spring salmon run of 1948, it was necessary to trap the fish in the lower river and transport them overland to a canal whence they could reach the spawning beds. Two men are using a short net to herd the salmon out of the trap and into the bucket, which is nearly submerged at the left. By means of a derrick, the bucket of fish is transferred to the tank truck in the background. *Photograph by D. H. Fry, Jr., Hills Ferry, May, 1948*

BOTTOM FISHERY

The trawl fishery for sole, sand dabs, flounders, and other bottom fish is one of the oldest commercial fisheries in the State. Prior to 1940 most of the vessels engaged in dragging were owned and operated by the producing companies. Double dragging (paranzella) necessitated the operation of two large vessels to drag the net along the bottom of the ocean. Inasmuch as the initial investment of each vessel was great, and two vessels were required to perform one fishing operation, this

method of fishing was logically financed and directed by the fish companies. At this time there were less than 20 vessels engaged in the fishery.

With the advent of World War II the loss of several vessels to the armed services gave impetus to a change to otter trawl gear. Otter trawl fishing is carried on by one vessel. With an unlimited market supplied by the military, the use of otter trawl gear spread through the fishery. There were no paranzella (double drag) operations during this biennium. The expansion in otter trawl boats continued until over 80 vessels are now engaged in this occupation. Development of dragging techniques has enabled some trawlers to extend their operations from 100 fathoms to as deep as 230 fathoms. This extension in range has opened new grounds to the fleet, and has resulted in heavy catches in this new area. Development of new processing methods in handling, filleting, and freezing has enabled the companies to keep abreast with the increasing catches. However, all is not well with the industry. Individual boat catches have shown a continuous decline from 1940 onward.

Other factors not apparent on cursory examination of the statistical data make this condition more ominous than appears. Nearly all the otter trawl boats now engaged in the fishery possess sonic depth finders. These devices make it possible to return to the same depth and follow schools of fish in those depths that they are most abundant. The radio telephone has also added to the increased efficiency of the fleet. Formerly, considerable time had to be spent prospecting for schools of fish. Now the information gleaned from the radio telephone has reduced this scouting to a minimum.

The development of fillet lines, similar in mechanization to canning lines, enabled the fishery to take other species of fish in great quantity that were formerly unutilized. The rockfish trawl fishery was developed to such an extent that loads of 80,000 pounds per trip were possible.

Even with the increased efficiency resulting from the use of the electronic devices, and the production and utilization of abundant new species such as rockfish and dogfish, the catch per unit of effort decreased. The average catch per drag has fallen from about 2,000 pounds prior to 1940 to slightly less than 1,100 pounds in 1947—a decrease of 45 percent. This decline ties in with the general loss of control over the fishing operations by the companies.

Prior to 1940 the companies maintained a voluntary 5-inch minimum size on their trawl nets. When the fishery shifted to independent operation, the voluntary agreement no longer prevailed, and the size of gear decreased to as small as three and one-half inches. Consequently, many millions of small, unsaleable fish have been killed needlessly; and as a result, the bottom fish populations have suffered a loss of abundance.

During the past two years landings of sole have increased markedly (see Figure 16, and Table 6). This increase, most of which took place at Eureka and Fort Bragg, was due to the increased fishing intensity, and to operations in deeper water. Rockfish catches, which had increased in a phenomenal manner during the war, suffered a sharp decline. This was due in some measure to a shrinkage in markets following the curtailment of military purchases, but signs of scarcity of fish are apparent on some of the banks.

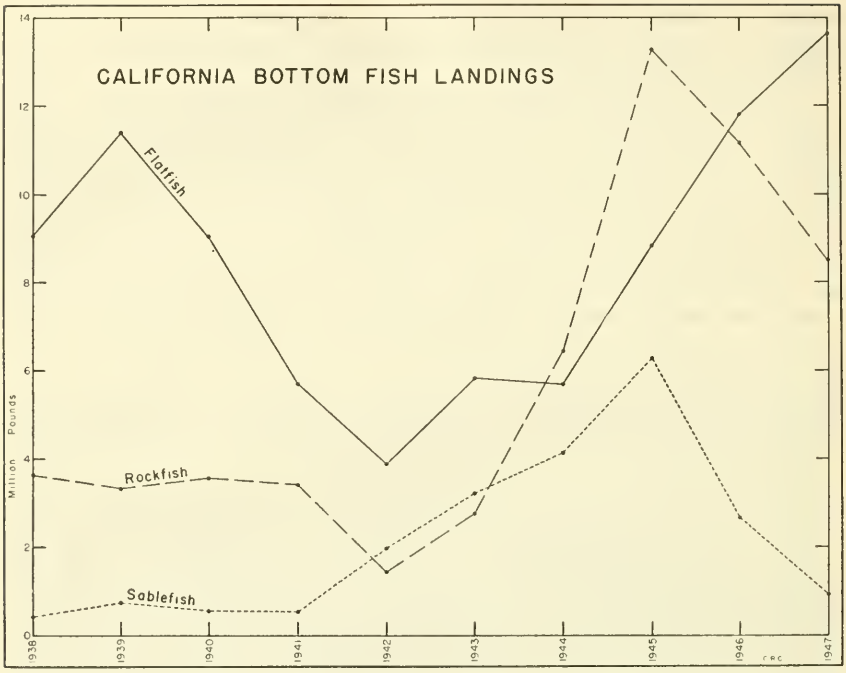


FIGURE 16. California landings of flatfish, rockfish, and sablefish, 1938-1947. Flatfish includes all species except halibut; i.e., various species of sole, sand dabs, starry flounder, and turbot. The flatfish have once again become the most important factor in the trawl fishery, having regained the lead held briefly by rockfish. The decline in the sablefish catch has caused much concern, as this valuable species has been subjected to too intensive fishing

The sablefish (black cod) fishery underwent a serious decline (see Figure 16). This fish, valuable for smoking, filleting, and vitamin oil, has been the object of heavy fishing effort, and has become badly depleted. Concern for the future, expressed by fishermen and by the Pacific Marine Fisheries Commission, has resulted in our commencing an investigation for obtaining the facts required to ensure a sustained yield.

Catches of ling cod (cultus) have increased to a marked extent (see Table 6), to compensate partially for the drop in sablefish production.

The soupfin and dogfish sharks continued to be the objects of an intensive fishery for Vitamin A products. The yield of soupfin had so diminished by 1948 that many of the former operators were leaving the industry. As a price level was maintained that somewhat compensated for the decrease in production, the decline was not felt by the industry until the level of abundance became so low that it was no longer masked. Many of the individuals who are now engaged in the fishery are doing so only until the gear that they possess is worn out. The expense of gear is such that the return to the fisherman is not sufficient to defray the costs of replacing the gear at current prices. Legislation was enacted which, although beneficial, is not sufficient in itself to enable the fishery to recover under present fishing levels. The only solution to the problem is a reduction of intensity.

The dogfish is taken by trawl nets in the northern part of the State, principally during December and January. As these fish are of the same group that range the coasts of Washington and Oregon, and as Northern California is about the southern limit of their commercial distribution, the effects of the increased otter trawl fishery have not been noticeable on this species.

Bottom fish investigations dealing with over 20 commercially important species were reinaugurated during this biennium. Personnel was assigned to this work, and some start made toward solving the problems necessary for adequate management of this industry. Log book records which, due to personnel shortage had suffered seriously during the war, were obtained; and the collection of these statistics in the future was outlined in conjunction with the objectives desired in this fishery. The reopening of the Eureka laboratory at the close of the biennium, and the assigning of part-time personnel to the collection of biological data will enhance the current analysis of the many species that are included in the scope of these investigations. Graduate students at Stanford University, working in cooperation with the bureau, have made valuable contributions to the life-history studies of the sand dab and starry flounder.

CRAB

The crab fishery of Central and Northern California has undergone tremendous expansion since prewar days. This luxury item is now caught and marketed in mass production quantities. Ten years ago the catch was controlled by a tight organization that kept quantity low and price high. When the Eureka fishery developed to threaten the San Francisco monopoly, and when the more efficient trap or "pot" replaced the old

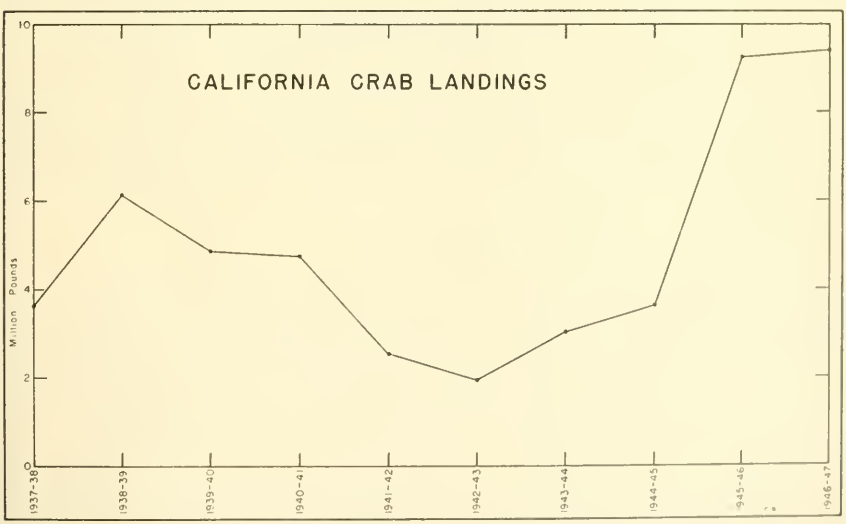


FIGURE 17. California crab landings, 1937-38 through 1946-47. Before the war, crab catches were restricted by a monopoly; during the war operations of the crab fleet were curtailed by security measures. The fishery is now undergoing the expansion usual to many of our fisheries

hoop net, catches increased considerably. After the war some of the trawlers that fish for sole and sand dabs modified their operations to fish for crabs. At the same time there was an expansion of "crab picking" to provide fresh and frozen crabmeat to restaurants. The catch increased from three or four million pounds a season to over 9,000,000 in 1945-46 and 1946-47 (see Figure 17). A small crab canning industry developed in the San Francisco and Eureka regions, with 15,000 cases (48 half-pound cans) produced in 1946, and 6,000 cases in 1947.

To prevent the waste and over-exploitation inherent in trawl operations, this type of crab fishing was curtailed by legislation enacted in 1947. As a result, the fishery is now on a more stable basis.

In early 1948 the bureau instituted a biological investigation of the crab to determine if the stock can withstand the intensified fishery and to ascertain what precautions might be necessary. This study is being made in cooperation with the fishery agencies of Oregon and Washington, under the sponsorship of the Pacific Marine Fisheries Commission.

SQUID

During the biennium, the squid fishery centered at Monterey continued at a high level. Catches in 1946 exceeded all previous records, with landings reaching 38,000,000 pounds (see Figure 18). This enormous

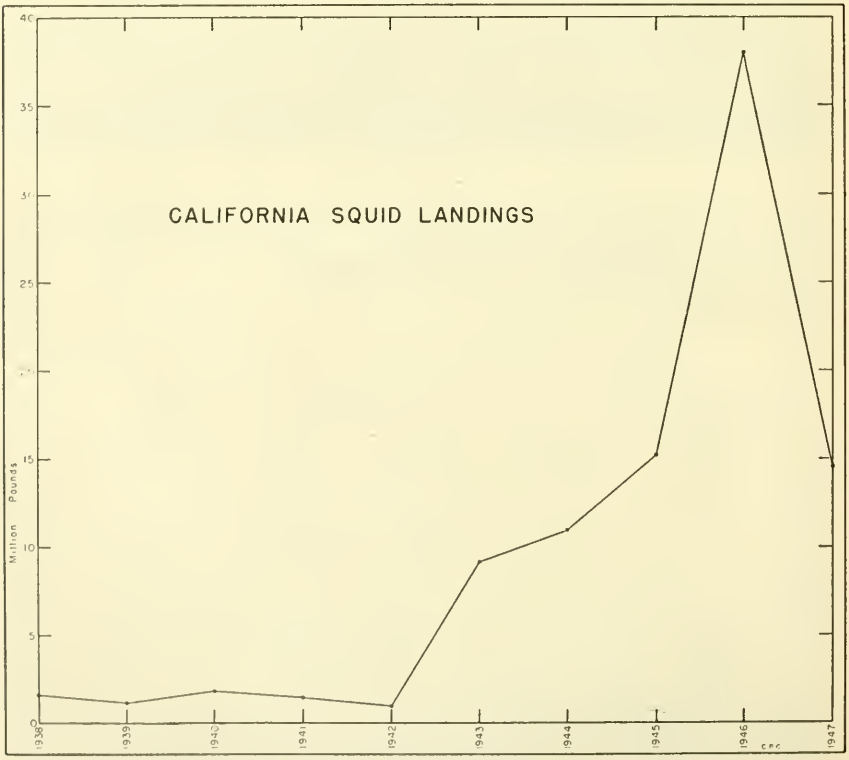


FIGURE 18. Poundages of squid landed in California, 1938-1947. The rapid increase after 1942 resulted from an expansion of the fishery in Monterey to supply a canning industry

catch was made to fill government orders for canned squid for relief exports. The pack exceeded 640,000 cases, which was more than double the sardine pack at Monterey for the same period. With relief purchases tapering off in 1947, the catch dropped to the 1945 level which was still far greater than earlier seasons. The 1947 catch of 14,500,000 pounds produced a pack of 230,000 cases.

To determine whether the expanded fishery might endanger the squid population, a biological study of the Monterey fishery was instituted in 1946. This investigation, carried on by Stanford University in cooperation with the bureau, includes length frequency samples, spawning and breeding habits, life-history of early stages, and assessment of possible damage to the eggs by the net fishery.

ABALONE

Abalone landings continued to increase during this biennial period. The area about the Channel Islands, which could not be effectively worked during the war, has added an appreciable quantity to the usual take along the coast of the mainland.

A great many divers entered the fishery and caused something of a patrol problem. Many of these aspirants were construction divers, ex-navy men with some experience in shallow water rigs, or individuals with no experience, attracted to the fishery by what seemed to them to be very remunerative returns.

It requires a year or 18 months to make a proficient abalone diver; and most of the tyros were financially unsuccessful. Under normal conditions 12 to 15 abalone crews supply the market, but during the 1946-48 period 40 to 50 crews were operating. Most of the novices have been eliminated by their inexperience and consequent financial insolvency, and by the Bureau of Patrol which apprehended them trying to augment their earnings by taking undersized abalones.

Because of the expansion in this fishery, and the seriously overfished condition of the beds, the Legislature authorized drastic regulations to control the industry. Although illegal practices have been cut appreciably, there has been no general improvement in the stock of abalones; and it may be necessary to impose further restrictions which have already been authorized by the Legislature.

OYSTER

Our oyster industry, which is based on an exotic species (*Ostrea gigas*) from Japan, suffered during the war from a lack of seed. We have not so far been able to obtain a natural set of these oysters, and the seed supply from Japan was, of course, not available. The stock of marketable oysters was practically exhausted by the end of the war.

An intermittent set of these oysters is obtained in the Puget Sound area, and some seed was imported shortly before shipments were resumed from Japan. The four oyster companies are building up their beds with yearly shipments of seed from Puget Sound and from Japan, and in a year or 18 months should again be producing a considerable quantity of desirable food.

In 1946-47 4,400 strings (equivalent to 1,500 cases) of seed were trucked in from Puget Sound, and 750 cases were shipped in from Japan.

In 1947-48 850 cases from Japan were planted in California.

All shipments from outside the State were inspected to ensure that no harmful pests were present. Observations of local spawning were made in an effort to determine what factors are responsible for the occasional success. Progress of the imported seed was observed, and we made one abortive attempt to introduce a Japanese hybrid variety which is reported to be very desirable.

PISMO CLAM

In September, 1947, due to legislation enacted in an effort to conserve our rapidly decreasing stock, the Pismo clam of California was taken from the list of commercial species. In 1946 the local commercial take was 69,000 pounds and through September, 1947, the local take amounted to 58,000 pounds.

During 1946 approximately 11,408,000 pounds of Pismo clams were shipped into California from Mexico; in 1947 this figure was approximately 1,807,000. The drop from over 53,000,000 pounds in 1945 resulted because of a decrease in canning. Most of the present importations from Mexico are going into the fresh fish markets to meet a demand formerly supplied by local clams.

Pismo clam investigations were re-established in 1946, and the regular annual census at Pismo Beach resumed. No good sets on this beach occurred in either 1946 or 1947. In addition, a special study of the differential growth rate on various beaches of southern and central California is being made.

OCEAN SPORT FISHING

This investigation is based on a record of the total annual marine catch taken by sport fishermen, and is obtained from data supplied by sport boat operators. The Bureau of Marine Fisheries, early in 1946, was able to resume the sport fishing program launched in 1936. A system, making it possible to check individual boat catch figures on any chosen day, was inaugurated. During 1947 a total of 87 sports boats were spot checked at their landings for the accuracy of their records. Within the first six months of 1948 approximately 100 boats were also tested for accurate reports.

The growth of the sport fishing fleet in the years 1946 and 1947 is reflected in the following table:

	1946	*1947*
Number of boats	150	378
Number of fishermen	206,979	439,270
Number of fish caught	1,227,818	2,392,016

Although 1948 promises to be a greater year than 1947, it is not expected that the increase will be so outstanding. Monthly summaries of the 1948 sport fishing season have been prepared and presented to various news services. These summaries have appeared regularly in several newspapers. Personal interview questionnaires have been used to some extent

FIGURE 19. Sport fishing aboard a party fishing boat in Southern California waters. About 400 boats are engaged in carrying anglers on fishing trips along the California coast. *Photograph courtesy of Pier Point Landing, Long Beach*

in an effort to determine how often the average fisherman tries his luck. Each boat owner and his operator received a mimeographed letter stating the aims of the Bureau of Marine Fisheries in regard to conservation of the sport fishing resources. Some of these operators, by arrangement, are furnishing specimens for identification and life-history work.

BAIT FISHERY

Following the expansion of ocean sport fishing in Southern California, particularly since 1925, bait hauling as a supporting industry necessarily expanded at a proportional rate; and the Bureau of Marine Fisheries in 1938 instituted a system for determining the amount of live bait taken. The skipper of each bait boat is required to keep a daily record in numbers of scoops. Figures for the years 1939-1942 are on file. None are available from 1943 through 1945 as wartime security regulations practically eliminated bait hauling. Records for the last two years, 1946 and 1947, mark the beginning of a new era in the bait industry.

Bait landings also furnish an indication of the sardine spawning success as sardines during their first year of life constitute an important part of bait poundage. Indications are that spawning success was only slightly improved during this biennium over the 1940-1942 spawning seasons. All bait figures since 1939 fail to compare favorably with the sardine hatch of that year.

An attempt has been made to accompany each of the twenty-odd bait boats on at least one fishing trip during the calendar year. Essential information is gathered at this time. Boats are checked for the weights of the scoops, and this figure, multiplied by the total number of scoops, gives the total number of pounds taken as bait. A careful record is made of the gear in use, the proportion of species taken, and notes kept on innovations in the fishery.

Samples of anchovies and sardines are taken from every bait boat visited, and the age and length composition is determined. In 1946 and 1947, of the six species of fish commonly found in the bait catch, anchovy comprised 75 percent of the total, and sardines 20 percent, with the remaining 5 percent being composed of queenfish, kingfish, smelt, and pompano.

During this biennium many boats have installed submarine sounding devices to enable operators to detect subsurface schools of fish. One self-propelled bait receiver is in use, and a successful experiment has been made, utilizing cement bait receivers that are capable of floating without additional support. Extremely light aggregates are used in the cement. Bait boats in the Los Angeles Harbor area are now successfully fishing at night using floating lights which serve to attract and hold scattered fish.

UNDERSEA OIL EXPLORATION

Exploration for undersea deposits of oil expanded rapidly during the biennium; and by 1948, 20 oil companies had applied to the Fish and Game Commission for permits to carry on such investigations. The oil-bearing strata are located by firing explosive charges in the overlying land or water surface. The bureau continued its regulation of this exploratory work through its permit system, and made additional investigations on the destruction of marine life which may result. A summary of these findings was published in *California Fish and Game*, April, 1948. An observer worked at sea at all times with the exploratory crews. Cost of this supervision is borne by the oil operators.

Because of the large number of applications for permits, the Bureau of Marine Fisheries in May, 1948, met with the oil companies, and through their aid set up preliminary arrangements for joint operations of all oil companies in future exploration. This will do away with repetition of activities in each area by additional oil companies. Thus, fish life will be saved, and the oil operators will carry out their research more economically. The waters of the State have been divided into 15 areas, and the dates designated when explorations will be permitted in each area. These dates are based on the seasons of the year when the fish population is known to be at a minimum in an area.

SEA LIONS

In order to assess the extravagant claims made by fishermen that sea lions have increased to the point where they menace the fish supply, and the equally wild assertions of some naturalists that these animals are becoming extinct, the bureau keeps track of their numbers by means of periodic counts on the rookeries.

The count made in June, 1946, indicated that sea lions had increased somewhat. The 1947 census disclosed a population of 5,666 Steller sea

lions, and 3,050 California sea lions. These figures are somewhat below the 1946 counts, but a little above the previous average.

The 1948 count was incomplete because of adverse, foggy weather, and unavailability of equipment. Where the animals were counted, they were slightly less numerous than in 1947, but any differences noted were inconclusive.

In 1947, as in the previous year, some of the rookeries were counted from Navy blimps, through the courtesy of the Navy. The remainder of the counting, that year, and all the work in 1948 was done in cooperation with the Bureau of Patrol, using their planes and boats. The use of aerial photographs has increased the accuracy of these surveys.

The conclusion to be drawn from the counts is that the sea lion population appears to be in reasonable balance, and is neither becoming so high as to be dangerous to the fisheries, nor on the way to extinction. An epidemic caused numerous deaths among the California sea lions during the past winter, but no losses occurred among the Stellers. Several permits were issued for the commercial capture of sea lions to check possible excessive expansion of the population, but pursuit of the animals proved to be economically infeasible and only a few hundred were taken.

RESEARCH VESSELS

Our seagoing research program was not resumed until late in the biennium for the lack of a vessel. The division's research vessel "N. B. Scofield" served throughout the war in the Army. At the conclusion of hostilities, negotiations for her return were initiated. These dragged on for month after month with the State exerting every possible effort to unravel military red tape. Finally, in June, 1947, the Army made a cash settlement of $65,000 for damage incurred, and returned the vessel. She was in deplorable condition, and it took the entire sum and months of work to put her in shape. The shakedown cruise was made in February, 1948.

The first postwar research voyage was made by the M. V. "N. B. Scofield" in March and April, 1948, as reported in the section on sardines. Before the biennium closed, the vessel had made some short trips offshore in tuna exploratory work, and to test gill net fishing for tuna.

Following the collapse of the sardine fishery, the fishing industry became aware of the need for additional research to solve the problems of fluctuating fish populations. It was realized that all available research agencies must work together and put the largest possible research fleet into operation. We felt that in order to take part in the expanded sardine research program, and at the same time do justice to the equally pressing problems facing the tuna, mackerel, and trawl fisheries, we would need at least one additional research vessel. For many months we sought a suitable craft, and finally located a surplus Army freighter that could be converted into a good research vessel. This ship, renamed "Yellowfin" for our most important species of tuna, was purchased on May 26, 1948. As the biennium ended, she was awaiting reconversion.

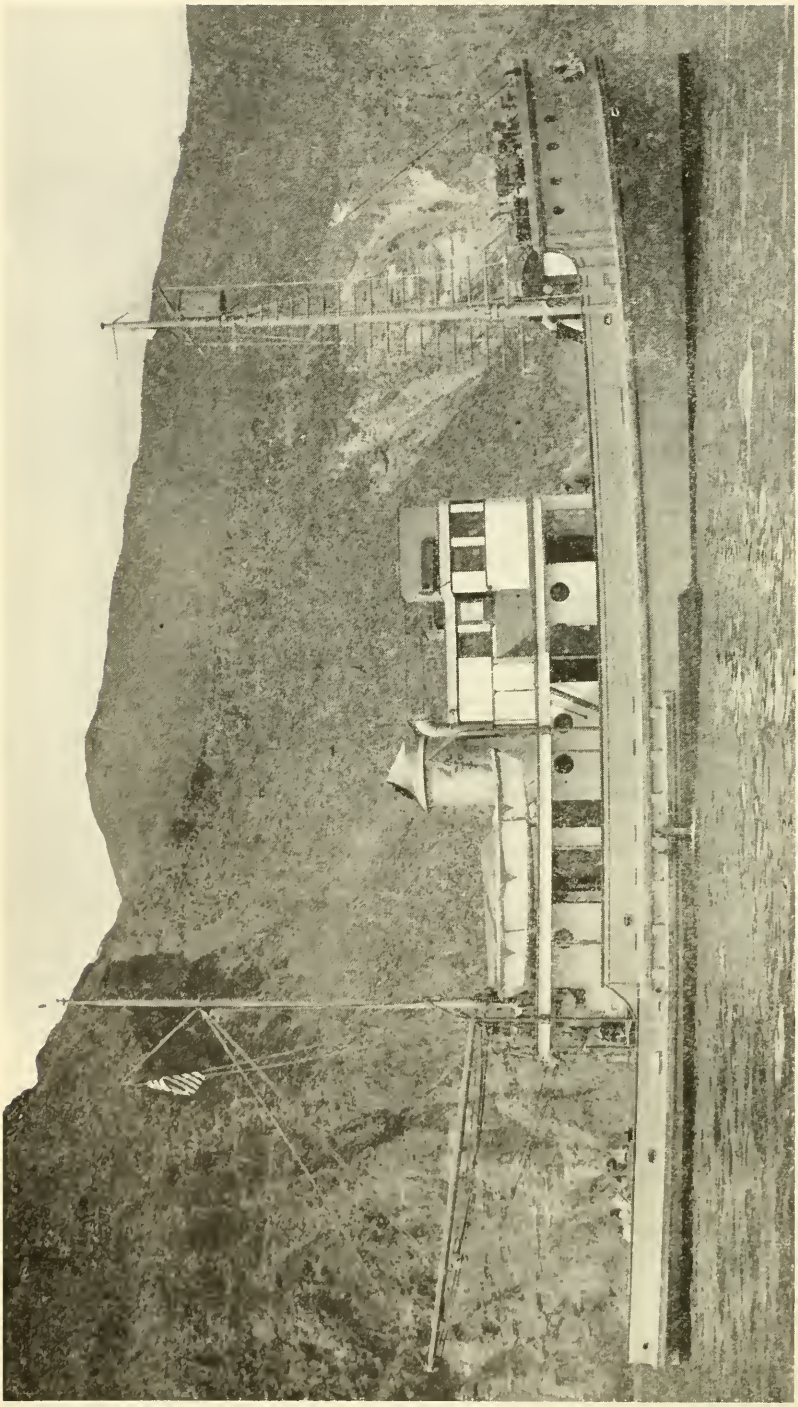


FIGURE 20. The M. V. "N. B. Scofield," research vessel of the Division of Fish and Game, near Ensenada, Lower California, on a sardine investigational cruise. This vessel, shown here on her first postwar research trip, was completely overhauled and rebuilt after returning from military service. *Photograph by John E. Fitch, March 27, 1948*

FISHERIES STATISTICS

Due to the shortage of clerical help and lack of field work during the war years, it was with difficulty that California maintained the leadership it had held for 30 years in its system of fisheries statistics. But during the past biennium the back log of basic work was mastered with the aid of additional tabulating equipment and a normal clerical staff. Unfortunately, the field work is still lagging. The system has become complicated; and the danger of inaccuracies has mounted due to special concessions made to accommodate the industry, because of changes in delivery and marketing procedure, and through the use of the record for purposes other than the study of abundance.

In the spring of 1948 a conference was called to review the present laws and policies governing the collection and compilation of the statistical records. Plans were made for improvements which must be introduced gradually, but which will make the system function with greater efficiency and meet the needs of changing conditions.

With the return of the research men from war activities, resumption of the studies of specific species was of prime importance. Of these statistical studies, the sardine project was the only one which was carried on unabated during the war years. Despite the reduction in catch, the sardine still held first place in poundage in 1947 (255,500,000 pounds, $5,800,000 value). The combined poundage of the five tunas for 1947 threatened this lead, with the value six times greater than that of sardines (250,000,000 pounds, $39,000,000 value). It was therefore fitting that the tunas be given first attention in the postwar program. A statistical study of the yellowfin and skipjack was undertaken. Tabulations began with 1934 where the work had been dropped, and continued through 1947.

Jack mackerel had reached fourth place in poundage in 1947, and had usurped the place of Pacific mackerel in importance among the species. The Pacific mackerel study was resumed with tabulations for the year 1939, where it had been interrupted; and the Jack mackerel records were begun for this same year, to be carried through the current season. Salmon and bottom fish work started with tabulations for 1946, the intervening years' work to be completed when time permitted.

The marine sport catch record was nonexistent for several years because national safety restrictions curtailed the sport fishery, and no attempt was made to collect a record. In 1946 normal activities resumed, and by 1947 the volume of the record was enormous. During 1947 the volume of punch cards required for the 8,000,000-pound marine sport catch exceeded the volume of cards used for the 800,000,000-pound commercial catch. This volume was caused by the great number of sportsmen recording small and varied catches to make up the final total.

It is with satisfaction that we review the accomplishment of the past two years, for it brought out the fact that the statistical record of our fish catch had not lost value or continuity despite curtailment during the war years.

PUBLICATIONS BY STAFF MEMBERS OF THE BUREAU OF MARINE FISHERIES

Fish Bulletin No. 65. Analysis of Populations of the Pacific Sardine on the Basis of Vertebral Counts. By Frances N. Clark. 26 pp.

Fish Bulletin No. 66. Drift and Set Line Fishing Gear in California. By W. L. Scofield. 38 pp.

Fish Bulletin No. 67. The Commercial Fish Catch of California for the Years 1945 and 1946. By the Staff of the Bureau of Marine Fisheries. 80 pp.

Fish Bulletin No. 68. Common Marine Fishes of California. By Phil M. Roedel. (In press at close of biennium.)

Fish Bulletin No. 69. Age and Length Composition of the Sardine Catch Off the Pacific Coast of the United States and Canada, 1941-42 through 1946-47. By Frances E. Felin and Julius B. Phillips. (In press at close of biennium.)

Fish Bulletin No. 70. A Preliminary Population Study of the Yellowfin Tuna and the Albacore. By H. C. Godsil. (In press at close of biennium.)

Alaska Codfish From California Waters. By J. B. Phillips. California Fish and Game, Vol. 32, No. 3, pp. 156-157.

Rare Fishes Taken Near Los Angeles. By Anita E. Daugherty. California Fish and Game, Vol. 32, No. 3, pp. 157-158.

California Sea Lion Census for 1946. By the Staff of the Bureau of Marine Fisheries. California Fish and Game, Vol. 33, No. 1, pp. 19-22.

The Effect of Explosives on Marine Life. By J. A. Aplin. California Fish and Game, Vol. 33, No. 1, pp. 23-30.

Pismo Clams of San Quintin, Lower California. By J. A. Aplin. California Fish and Game, Vol. 33, No. 1, pp. 31-33.

Pismo Clam Increase. By J. A. Aplin. California Fish and Game, Vol. 33, No. 3, pp. 129-131.

Rare Fishes Taken Near Los Angeles. By John E. Fitch. California Fish and Game, Vol. 33, No. 3, pp. 191-192.

Summary of Recovery of Califonrnia Sardine Tags on the Pacific Coast. By J. F. Janssen, Jr. California Fish and Game, Vol. 34, No. 1, pp. 3-10.

Basking Shark Fishery Revived in California. By J. B. Phillips. California Fish and Game, Vol. 34, No. 1, pp. 11-23.

Sablefish Run at Monterey Bay. By K. W. Cox. California Fish and Game, Vol. 34, No. 1, p. 37.

Occurrence of the Black Skipjack (*Euthynnus lineatus*) off Southern California. By Phil M. Roedel. California Fish and Game, Vol. 34, No. 1, pp. 38-39.

Extension of the Range of *Luvaris imperialis* Rafinesque. By W. E. Ripley. California Fish and Game, Vol. 34, No. 1, pp. 39-40.

Use and Effect of Explosives in California Coastal Waters. By J. E. Fitch and P. H. Young. California Fish and Game, Vol. 34, No. 2, pp. 53-70.

A Review of the Southern California Spiny Lobster Fishery. By Robert C. Wilson. California Fish and Game, Vol. 34, No. 2, pp. 71-80.

1947 Pismo Clam Census. By the Staff of the Bureau of Marine Fisheries. California Fish and Game, Vol. 34, No. 2, p. 82.

Landings of Sardines Along the Pacific Coast. California Fish and Game, Vol. 34, No. 2, pp. 82-83.

The California Sea Lion Census for 1947. By P. Bonnot and Wm. E. Ripley. California Fish and Game, Vol. 34, No. 3, pp. 89-92.

Some New and Unusual Fishes From Southern California. By J. E. Fitch. California Fish and Game, Vol. 34, No. 3, pp. 133-135.

Comparison of Calculated Fish Lengths Based on Scales From Different Body Areas of the Sardine, *Sardinops caerulea*. By J. B. Phillips. Copeia, 1948, No. 2, pp. 99-106.

Pacific Mackerel in the Gulf of California. By Phil M. Roedel. Copeia, 1948, No. 3. (In press at close of biennium.)

Circular No. 21, Statistical Report on Fresh and Canned Fishery Products, Year 1946.

Circular No. 22, Statistical Report on Fresh and Canned Fishery Products, Year 1947.

PACIFIC MARINE FISHERIES COMPACT

During their 1947 sessions, the State Legislatures of Washington, Oregon, and California enacted legislation authorizing the execution of the Pacific Marine Fisheries Compact. The governors of the three states subsequently executed the compact, the purposes of which are expressed as follows: "The purposes of this compact are and shall be to promote the better utilization of fisheries, marine, shell, and anadromous, which are of mutual concern, and to develop a joint program of protection and prevention of physical waste of such fisheries in all of those areas of the Pacific Ocean over which the States of California, Oregon, and Washington jointly or separately now have or may hereafter acquire jurisdiction."

The compact sets up the Pacific Marine Fisheries Commission, and designates the fisheries agencies of the three states to act as its joint research body. Organizational meetings were held at Portland, Oregon, in November, 1947, and January, 1948. The research staffs held a joint meeting in San Francisco during March, followed by the third meeting of the commission in April at San Francisco. The commission is formulating recommendations on conservation legislation for the consideration of the member states, and is coordinating the various research programs.

The California members of the commission, appointed by the Governor, are:

Mr. Richard S. Croker, Chief, Bureau of Marine Fisheries.
Senator Jesse Mayo, Angels Camp.
Mr. Eugene D. Bennett, San Francisco.

A staff member of the Bureau of Marine Fisheries, Mr. D. H. Fry, Jr., has been placed in charge of California's share of the cooperative research program.

BUREAU OF FISH CONSERVATION

An understanding of the present program of the bureau is basic for a consideration of expansion or change in operations. A short time before the war a plan for future operation was approved by the commission and the accomplishments thereunder have been reported upon informally from time to time and at regular intervals in the biennial reports. There have naturally been some modifications and the war necessitated deferment of many activities that had been planned.

A long-term program with definite objectives is particularly desirable for the conservation work of public agencies because of the continued demand by interested individuals and groups for innumerable short-term activities which are never coordinated and in fact, are usually abandoned by the proponents for new fads or fancies before the original objectives are attained. Regardless of the individual merits of the projects, little worthwhile can be accomplished if the division is forced to abandon them before completion to undertake some new ventures. The waste of time, effort and money resulting from such unplanned activity can be largely, but not completely, avoided by setting up a sound long-term program and sticking to it except for minor modifications. Even though the plan may be in part defective, the results of long-term coordinated work are bound to be more profitable than hit or miss work, even on a large scale.

The present program of this bureau has three broad objectives, and under each, a number of related fields of activity. They can be most concisely presented in outline form.

1. Protection and improvement of environment and habitat for fishes. In other words, to provide satisfactory living conditions for fishes. The main lines of activity in this field are:

   a. Protection of existing fishing waters from the adverse effects of the utilization of water for other purposes. It is hardly necessary to point out that the use of water for domestic use, irrigation, power and industrial purposes is continuing to increase. One thousand one hundred twenty-six applications for new diversions were filed during the biennium. There are over 600 dams now existing in the State, and many more are planned or under construction. In order to make proper recommendations for the protection of fish it is necessary to study each of these projects in detail and frequently the problems are so complex that the studies extend over a considerable period of time. It has been found that many adjustments in construction or operation are possible which make these projects less damaging to fish life, and where negotiation fails to bring satisfactory adjustment, recourse is had to the provisions of law for the release of water and the construction of fish ladders and screens. Screening of diversions will only be possible on a large scale after the revision of the present screen law.

b. Stream flow maintenance in certain areas of the high Sierra Nevada has been found possible in past years through the construction of small storage dams. Two areas, Desolation Valley and Cherry Creek, have been developed through cooperation with local sportsmen and the U. S. Forest Service. This work is only possible where suitable sites exist, but several additional areas are known where more dams could be constructed.

c. An increasingly important factor affecting waters of this State as habitat for fish is pollution by industries and municipalities. The amount of waste that State waters are called upon to handle increased greatly during the war, and will remain at a high level because of the great growth in the population of the State. Enforcement of the pollution laws is in the hands of the Bureau of Patrol, but the Bureau of Fish Conservation supplies the technical service needed in connection with most pollution cases. One Assistant Sanitary Engineer is assigned to the work, and his time is fully occupied. It may therefore be necessary to add another man to the staff next year.

It has become more and more evident that the complexity of many pollution problems makes it necessary for us to seek advice and assistance from other interested agencies, particularly the State Department of Public Health. Such cooperation is mutally advantageous and could be facilitated by such enabling legislation as was proposed at the last session of the Legislature, but which failed of passage. The most serious pollution is now caused by food processing plans and municipal sewage, or a combination of the two. Although partial removal of cannery sludge is by no means a complete solution, it is recommended that the commission continue in effect the present regulation requiring screening of cannery sewage.

d. In 1945, the bureau was given the difficult task of handling the screening of diversions. For a considerable period prior to that administrative change, installation of new screens was confined to replacement of old screens since the law provided that all new installations be paid for and maintained jointly by the owner and the division. The obvious difficulties of accounting, particularly since bills for maintenance are rendered to us by the owner and in most cases we would have no means of checking the labor involved, were a bar to the installation of new screens. Furthermore, very few of the screens installed in the past had ever been consistently tested to determine their efficiency in doing the job of stopping small fish. It has therefore been necessary for us to develop our program slowly. To start with, we set up a fish screen and maintenance crew, largely with new personnel. A quonset building was set up in Yreka as a shop and new equipment ordered. Study was immediately given to the efficiency of various types of screens, both new and old, and that work is still continuing. We believe that in the near future we will be ready to undertake an expanded program of new installations, providing changes can be made in the law. It is recommended that these

changes include provision for the installation and maintenance by the division of all screens in ditches except those constructed by the United States and those supplying water for power generation.

Part and parcel with screen installation is the problem of maintaining and improving some of the older ladders. In the northern part of the State there are many old ladders which should be reconstructed. Most of them were installed according to specifications and in good faith. Many of them have been known to be inadequate, and by law the division is authorized to replace them.

During the last two years we have removed several abandoned dams in order to make streams passable by fish. The actual removal of these dams is not difficult, but it is a tedious process finding the owners and getting their consent to the removal. Both ladder reconstruction and dam removal should be continued as rapidly as possible.

e. Rough fish control is one of the newer techniques which has been found very effective in increasing productivity of certain waters. It is usually accomplished through the use of rotenone, the well-known insecticide. Waters can be treated to remove all fish life at a cost for materials of from $0.60 to $1.20 per acre-foot of water. Gull Lake, Mono County, was the first large lake treated. This work was done in 1940, and improved fishing was evident after replanting the following season and continued through the war years. Although rough fish are again present, they have not yet become so abundant as to limit trout production. Rehabilitation of lakes and reservoirs by this method is very worthwhile even though the waters may eventually become restocked with rough fish. During the present biennium money has been budgeted for the purchase of poison and a large number of waters have been treated.

2. The second broad field of activity is that of study and research. The number of questions of fact regarding fish and game that are raised at almost every commission meeting, many of which remain unanswered, are an indication of the continuing need for the gathering of facts about our fishes and fishing waters and their proper management. The Fish Commission of California was established in 1870, but no full-time aquatic biologist was employed until 1925. That lone individual worked until his death in 1930, and the division then entered into an agreement with the U. S. Fish and Wildlife Service for what was known as the Cooperative Trout Investigations, and it was not until 1937 that the division made any provision in its own organization for the work of trained biologists on fresh-water fishery problems. That staff was reduced to four individuals all during the war period.

For purposes of organization, the State has been divided into eight districts and eventually it is hoped that it will be possible to place each district in charge of an experienced biologist, who can have two or three assistants. The present assignment of the permanent biological employees by districts is indicated on the following map.

The fact-finding program includes the following major projects to which could be added many minor routine problems that come up from day to day.

a. The physical inventory to determine the size, type, location and general suitability for fishes of the thousands of separate rivers, creeks, ditches, lakes, reservoirs, and ponds of the State is known as stream and lake survey. This is a continuing job which will never be completed because of the changes which are constantly taking place, and it is therefore carried on as opportunity permits.

b. The formulation of plans for management, including recommendations for seasons, size limits, bag limits, stocking, and improvement and protection of environment.

c. Determination of the best management techniques and practices through study of survival of planted and natural fish of various sizes and species under varying conditions, effect of stocking or removal of species. Work of this kind is now being carried on at Castle Lake, Siskiyou County; Clear Lake, Lake County; Millerton Lake, Fresno County; Santa Paula Creek, Ventura County; and Rush Creek, Mono County. Creel counts are being carried on at various times on the Truckee River, Upper Truckee, Shasta Lake, Conn Reservoir, and Stevens Creek Reservoir. Annual counts of salmon are made on the Eel River, Mad River, and Klamath River. Recovery of marked fish is being used at Lake Almanor to determine results of planting. A special project along these lines is now under way to determine the degree of depletion, if any, in the striped bass fishery and the further essential facts as to life history of the species in California necessary for management and protection from any adverse effects of the Central Valleys Project.

d. The study and treatment of hatchery diseases and the development of cheaper and better foods for hatchery use. Work along these lines has paid large dividends during the last eight years. Disease epidemics have been less severe, and our cost for fish food has been kept near prewar levels, while soaring in other states. Biologists have also assisted in recent experiments with planting trout from airplanes.

e. The biological staff also has to bear most of the increasing burden of preparing material for educational literature and movies, and speaking at sportsmen's meetings. Accompanying this report is a list of titles and abstracts of administrative reports and publications prepared by the biological staff July 1, 1946, to June 30, 1948.

3. Fish planting is the largest activity of the bureau, both in terms of expenditure and number of men employed. Over 20,000,000 trout and 3,500,000 salmon, weighing over 440,000 pounds, are now being produced in hatcheries for planting. Varying numbers of trout and salmon are obtained through rescue work and this is also the source of most of the warm-water species used for stocking. The division now has 22 permanently established trout hatcheries (at two of these salmon are also

reared), one hatchery for spiny-rayed fish, three hatcheries in experimental use and development, and one hatchery under construction. It is to be understood that the term hatchery as used in this report means a building where fish eggs are hatched and fingerlings produced, or a group of rearing ponds or possibly a combination of the two types of facilities.

The following is a list of the existing fish hatcheries operated by the Bureau of Fish Conservation during the biennium.

ALPINE COUNTY

Alpine Hatchery near Markleeville (seasonal). Temporarily closed. 30 troughs, no tanks or ponds.

FRESNO COUNTY

Huntington Lake Hatchery near Lakeshore (seasonal). 6 tanks, 16′ long; 3 are standard width of 4′ and 3 are less than 4′ in width.

Kings River Hatchery, 56 miles east of Fresno. 100 troughs, no tanks or ponds.

HUMBOLDT COUNTY

Prairie Creek Hatchery near Orick. 80 troughs, 5 redwood tanks, 4′ x 16′ x 30″, located outside of hatchery building.

INYO COUNTY

Mt. Whitney Hatchery and Black Rock rearing ponds near Independence. 120 troughs, 2 circular ponds, and 3 rectangular ponds at hatchery, used largely for spring spawning rainbow brood stock. Two large rearing ponds and one brood stock pond are maintained at Black Rock Springs.

KERN COUNTY

Kern Hatchery near Kernville. 10 troughs, 2 round redwood tanks 14′ in diameter, 30″ deep. 8 concrete ponds, 80′ x 12′ x 36″, two earth raceways divided into 5 compartments each, length of each raceway about 300′, average width about 6′, depth of water 14″.

LASSEN COUNTY

Lake Almanor Hatchery near Westwood. 96 troughs, 8 redwood tanks, 4′ x 16′ x 30″, located in hatchery building, and 3 cement ponds approximately 8′ x 30′ x 30″.

LOS ANGELES COUNTY

Whittier Hatchery. 6 ponds, 100′ x 12′. Temporary.

MADERA COUNTY

Madera Hatchery near Bass Lake (seasonal). 4 troughs, 10 tanks, 16′ x 4′ x 30″.

MARIPOSA COUNTY

Yosemite Hatchery in Yosemite National Park. 52 troughs, 4 tanks 16′ x 4′ x 24″.

MONO COUNTY

Hot Creek rearing ponds near Bishop. 34 troughs, 35 rearing ponds, 2 brood stock ponds.

PLACER COUNTY

Mt. Tallac Hatchery near Camp Richardson (seasonal). 52 troughs, 16 tanks 4′ x 16′ x 30″.

Tahoe Hatchery near Tahoe City, 64 troughs, no ponds or tanks.

PLUMAS COUNTY

Feather River Hatchery near Clio. 60 troughs, 4 circular ponds, 20′ in diameter, concrete construction.

SACRAMENTO COUNTY

Central Valleys Hatchery near Elk Grove. 19 bass ponds, 19 daphnia tanks.

SAN BERNARDINO COUNTY

Mojave River Hatchery near Victorville. 4 ponds. Put in operation June, 1947.

SANTA CRUZ COUNTY

Brookdale Hatchery near Brookdale. 40 troughs, 6 circular concrete ponds 16′ in diameter with an average depth of about 16″. One rectangular pond, concrete construction, approximately 35′ long, 12′ wide, average depth about 16″.

SHASTA COUNTY

Burney Hatchery near Burney. 100 troughs, no ponds.

Crystal Lake Hatchery. 24 ponds constructed and put in operation October, 1947.

SIERRA COUNTY

Yuba River Hatchery near Camptonville. 30 troughs. There are no ponds or tanks at this hatchery.

SISKIYOU COUNTY

Fall Creek Hatchery near Copco. 116 troughs, 9 ponds.

Mt. Shasta Hatchery near Mt. Shasta City. 458 troughs, 47 brood fish rearing and spawning ponds. 36 ponds of earth bottom and wood side construction are used for the holding of approximately 20,000 rainbow brood fish. Eleven ponds are used for the rearing of aged fish for planting and also to bring on fish to be set aside for brood stock.

TULARE COUNTY

Moorehouse Spring Hatchery near Porterville. 6 redwood tanks 14′ in diameter, 30″ deep. Put in operation June, 1947.

Kaweah Hatchery near Three Rivers. 60 troughs, no tanks or ponds.

Sequoia Hatchery near Visalia. Ten 14′ round redwood tanks, 30″ deep.

TUOLUMNE COUNTY

Basin Creek Hatchery near Tuolumne. 80 troughs, 9 tanks 16′ long, 4′ wide, 30″ in depth.

VENTURA COUNTY

Fillmore Hatchery near Fillmore. 8 troughs, 3 circular tanks, 30 rearing ponds.

The operation of all fish hatcheries is carried on under the direction of the Supervisor of Fish Hatcheries and seven Assistant Supervisors. One of these assistants has headquarters in San Francisco and has charge of the acquisition of property, equipment, and the planning of maintenance and the construction of new facilities. The other six supervisors have charge of the hatcheries in the various districts indicated on the attached map, which shows the location of existing and proposed hatcheries.

Tables in the appendix show the number of the hatchery-produced trout and salmon planted in each county in 1946.

PUBLICATIONS BY STAFF MEMBERS OF THE BUREAU OF FISH CONSERVATION

Development of Teeth in the California Fish *Atherinops affinis*. Garth I. Murphy. Copeia, 1947, No. 3, pp. 198-199.

Report on Fisheries Resources in Connection With the Proposed Yolo-Solano Development of the United States Bureau of Reclamation. Leo Shapovalov. California Fish and Game, Vol. 33, No. 2, pp. 61-88.

Distinctive Characters of the Species of Anadromous Trout and Salmon Found in California. Leo Shapovalov. California Fish and Game, Vol. 33, No. 3, pp. 185-190.

A System for Recording Measurements of Fish Scales. Leo Shapovalov. Transactions of the American Fisheries Society, Vol. 74, pp. 59-62.

The Steelhead Fishery. Leo Shapovalov. Pp. 22-36 of Co-ordinated Plans for the Management of the Fisheries of the Pacific Coast, submitted to the Pacific Marine Fisheries Commission, April 5, 1948. Processed.

"King and Silver." Leo Shapovalov. Tyee Tales, April, 1947.

Digest of California Angling Regulations. Prepared by Leo Shapovalov. California State Printing Office, May, 1947.

A New Transplant of the Piute Trout (*Salmo clarkii seleniris*) from Silver King Creek, Alpine County, California. Elden H. Vestal. California Fish and Game, Vol. 33, No. 2, pp. 89-96.

Castle Lake Trout Investigation, First Phase: Interrelationships of Four Species. J. H. Wales. California Fish and Game, Vol. 32, No. 3, pp. 109-143.

Castle Lake Trout Investigations: 1946 Catch, and Chemical Removal of All Fish. J. H. Wales. California Fish and Game, Vol. 33, No. 4, pp. 267-286.

California's Fish Screen Program. J. H. Wales. California Fish and Game, Vol. 34, No. 2, pp. 45-52.

Spawning Habits of the Striped Bass (*Roccus saxatilis*) in California Waters. Chester Woodhull. California Fish and Game, Vol. 33, No. 2, pp. 97-102.

SUPERVISORIAL AND BIOLOGICAL DISTRICTS AND LOCATION OF FISH HATCHERIES AND REARING STATIONS OF THE BUREAU OF FISH CONSERVATION, CALIFORNIA DIVISION OF FISH AND GAME

FIGURE 21

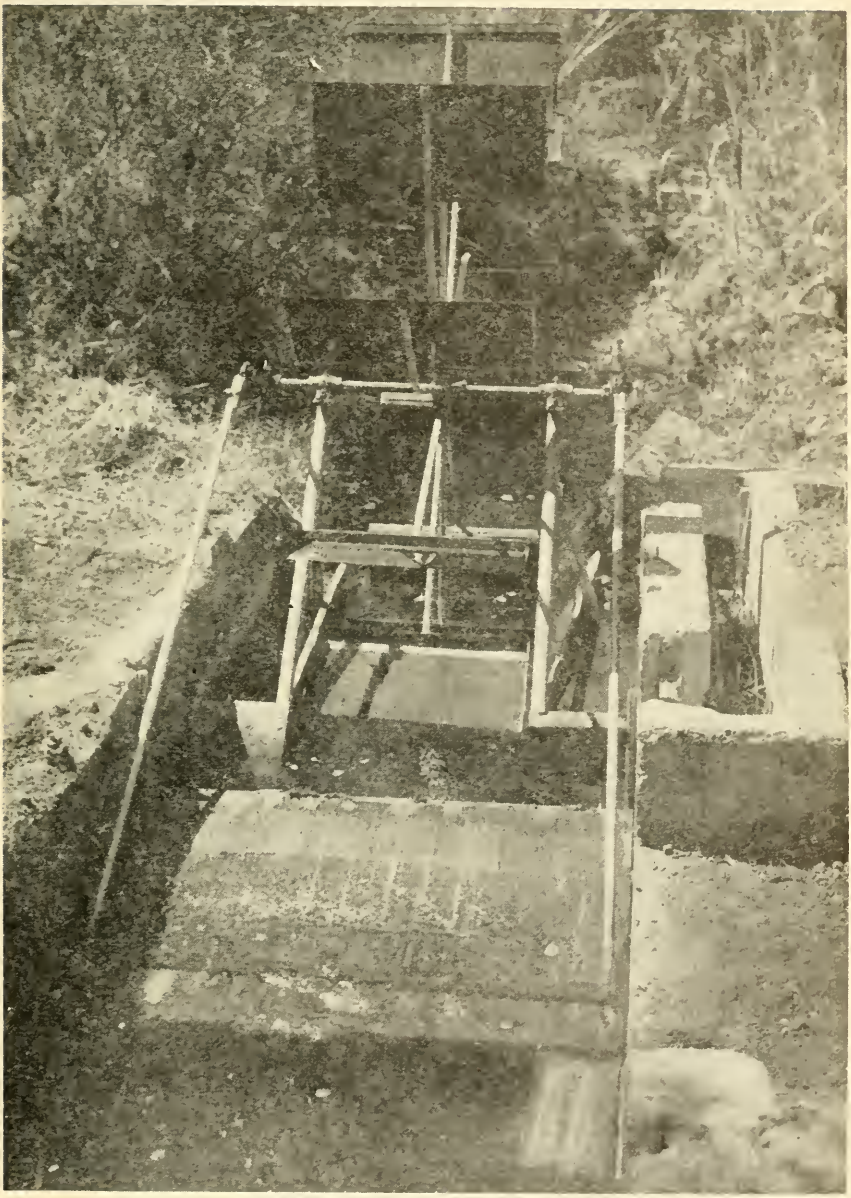


FIGURE 22. Perforated plate fish screen with cleaning bar developed by E. W. Murphey of the Division of Fish and Game and now under test on a tributary of the Shasta River. This screen has the characteristics of simplicity and low fabrication, installation and maintenance cost. It is particularly adapted to small ditches

Titles and Abstracts of Administrative Reports Submitted by the Biological Staff July 1, 1946, to June 30, 1948

CALHOUN, Alexander J.

Observations of the Striped Bass Fishery in the Sacramento Delta Area during April and May of 1946. Submitted July 11, 1946, 36 pp., 4 tables, 6 figures.

Abstract: Methods used in sampling the livery boat fishery are described. Fishing effort and average daily catch at Frank's Tract are discussed. Length frequencies and sexual maturity of the catch are discussed. The fishery in the main San Joaquin River is described. Average daily catch was between 1 and 2 bass per angler day in most samples taken. Fish were ripe almost without exception, and females averaged 26.5 inches, males averaged 18.5 inches, in the samples measured. Migration and spawning time, as revealed by catch observations, are taken up. The desirability of a closed season during the time of spawning is discussed, and it is concluded that such a measure has little to recommend it.

1944 Angling Catch Records of California. Submitted December 12, 1946. 18 pp. and tables.

Abstract: Results of the postal card survey of California angling catches in 1944 are presented. An estimated 1,420,000 striped bass were caught. Other estimates pertaining to the 1944 striped bass catch are derived and discussed. Other species are not considered because of the restricted scope of the 1944 survey.

Progress Report on Studies of Striped Bass Reproduction in the Central Valley, with a preliminary evaluation of the threat of the Delta Cross-Channel to the striped bass population. Submitted November 20, 1947. 49 pp., 3 figures.

Abstract: Distribution and abundance of early stages of striped bass in the Central Valley in 1947 on the basis of tow-net samples are outlined. Behavior of eggs, larvae and fry in response to currents is discussed, and it is concluded that prediction of losses of small bass at the Delta-Mendota pumps is impossible on the basis of present information.

Analysis of 1946 Striped Bass Party Boat Fishing Effort. Submitted March 9, 1948. 7 pp., 1 table.

Abstract: This report presents a breakdown of 1946 party boat permits issued in the San Francisco office by type of operator, as well as estimates of fishing effort expended by the various types, and for the striped bass party boat fishery as a whole.

CURTIS, Brian

The Status of the Salton Sea Mullet Fishery. Submitted October 30, 1946. 5 pp., 2 tables.

Abstract: Recapitulation of 1946 catch shows totals of 30,000 fish weighing 174,000 pounds, lowest since resumption of fishery in 1943, but probably due in part to death of many mullet in late 1945. Catch per net unit 3.5 pounds. No significant index of depletion. Maintenance of present regulations is recommended for 1947, with a biological study to delimit the spawning season.

Report of the activities of the biological staff of the Bureau of Fish Conservation for the 39th Biennium, July 1, 1944, to June 30, 1946. Submitted November 15, 1946.

Abstract: Describes the activities of the staff. Printed in large part in "Thirty-ninth Biennial Report of the Division of Fish and Game" as part of the report of the Bureau of Fish Conservation.

The Frog Lake (Nevada County) Fishery in 1946. Submitted April 7, 1947. 14 pp., 5 tables, 1 figure.

Abstract: Four years of planting 15,000 RT annually, after four years of planting equal number of RT, EB and BN, leave the BN still dominant in the catch (58 percent). Poor showing of RT is discussed; gill netting of large BN is recommended, and test of fall-spawning RT survival vs. spring-spawning stock.

Catch estimates and creel counts in California. Prepared for presentation on June 4, 1947, at Santa Fe meeting of Western Association of State Game and Fish Commissioners. 13 pp.

Abstract: Description of mail questionnaire used in sampling angler's catch and of methods of estimate. Estimates are given for the years 1936-1943. Correlation with survival data from creel counts indicates that only about one-eighth of total trout catch results from hatchery planted trout.

DILL, William A.

Trout and Salmon of California. 10 pp.

The Warm-Water Fishes of California Fresh Waters. 10 pp. Both submitted January 21, 1948.

Abstract: Brief discussions and descriptions of the various fishes, prepared for use at the wardens' schools conducted by the Bureau of Patrol.

DILL, William A., & SOULE, Scott M.

Paper work in fish management. Report No. 3. Establishment of standard methods. Submitted January 25, 1947. 11 pp. including 2 figures.

Abstract: Discusses need for uniformity and correlation in: Records of all files (in all offices) concerned with management; and in all instructions for use of files, forms, and procedures. Outlines present status of "standard" sets of instructions: Stream and lake survey (and forms); use of management binder system; filing and indexing of all types of stream and lake records. Defines "standard" methods and procedures. Explains necessary steps to take in preparing them and explanations. Lists bottlenecks to accomplishment of above.

Paper work in fish management. Report No. 4. A suggested set of instructions for use of the management binder system. Submitted January 25, 1947. 3 pp. letter plus set of instructions, ii plus 23 pp. (incl. 1 fig.) plus 4 pp. addenda.

Abstract: Instructions designed for use of hatcherymen, biologists, central office. Explains forms used in binder, how to fill them out, their arrangement and indexing; how to keep binders up to date; interrelationships of the three offices. Has filled-out sample forms. Accompanied by letter of explanation and miscellaneous addenda.

A fisheries survey of lakes in the Granite Creek Drainage, Madera County, 1946. Submitted April 29, 1948. 52 pp. including 3 figures (maps), 8 tables and 2 appendixes.

Abstract: Results of a July 1946 survey of 24 natural high-altitude trout lakes. Explains why past management has not been satisfactory. Gives general description of drainage, lakes, fish populations, accessibility, and fishing intensity. Compares past stocking with present fish populations. Recommends definite management practices including a new stocking policy, improvement work, improvement of field knowledge (by hatchery personnel) and records. Recommends additional surveys in areas. Gives methods (including a stocking table) and itinerary of 1946 trip. It is shown that despite little stocking, the "carry over" of hatchery fish may be high, and that natural propagation may often be sufficient to provide satisfactory fishing.

EVANS, Willis A.

Reconnaissance of Upper Sweetwater River, San Diego County, with reference to stream improvement. Submitted August 30, 1946. 8 pp. plus 1 map.

Abstract: The Sweetwater River was examined from Lake Loveland to headwaters. Conditions found unsuitable as year around habitat for trout below Hulburd Grove. Area within Cuyamaca State Park is only section satisfactory for permanent trout stream. Cold Spring Creek is best area. A two-mile section of it is recommended for stream improvement work in form of small rock check dams, done cooperatively by Division of Fish and Game and Division of State Parks. After improvement, plant with aged fish. Extreme headwaters should be planted with fingerling RB trout at periodic intervals of 4-5 years. The map indicates section of stream suitable as trout habitat.

FRASER, J. C.

Poisoning of McMurray Lake, Nevada County. Submitted January 15, 1948. 9 pp., 1 photo, 1 table.

Abstract: McMurray Lake, Nevada County, was poisoned with rotenone on September 14, 1947, to rid it of a large population of catfish. Report describes character of the lake, the poisoning program, and observations made during and after the poisoning. Seven brown trout were recovered and 22,672 catfish with an average length of 4.7 inches were actually counted. Catfish population was estimated at 33,000.

The Frog Lake (Nevada County) Fishery in 1947. Submitted March 21, 1948. 10 pp., 5 tables.

Abstract: 203 anglers fished 767 hours and caught 431 trout as follows: RT 85 (20 percent), EB 128 (30 percent), BN 218 (50 percent); average catch per angler 2.1; per angler hour 0.56. Fishing better than in 1947. BN still dominate catch; EB are increasing, probably due to natural reproduction; RT not increasing significantly. Marked RT were planted in 1947 in four groups; spring spawning and fall spawning from Mt. Shasta; same from Tallac. Objective: To determine relative survival by intensive counts in 1948.

MURPHY, Garth I.

A survey of Stony Creek, Grindstone Creek, and Thomas Creek drainages in Glenn, Colusa, and Tehama Counties. Submitted September 2, 1946. 28 pp., 25 photos.

Abstract: Brief survey to determine extent of trout in above drainages. In general trout water starts at 2,500 feet. Streams are relatively inaccessible, and well stocked with trout. Little planting needed. Streams lack adequate shade causing excessively warm water. Several possible hatchery and rearing pond sites discussed. Recommended: That a holding pond be established to accommodate at least 37,000 RT at 15 per ounce and that these fish be distributed by pack stock in Middle Fork of Stony Creek, Grindstone Creek, Killdry Creek, and Thomas Creek, that in cooperation with U. S. Forest Service increase of shade be attempted experimentally by planting willows and alders on a one-quarter mile section of South Stony Creek.

Clear Lake, Lake County, Investigation. Progress Report No. 1. Submitted September 27, 1946. 6 pp.

Abstract: A report on the material gathered during the summer of 1946, with recommendations for future investigations.

Observations on Conn Valley Reservoir, Napa County, on July 18 and August 3, 1946. Submitted September 27, 1946. 8 pp., 5 photos, 1 map.

Abstract: Thermocline at about 13 feet, with no 0_2 below. Water 75 degrees and up above thermocline. RT concentrated in creek arms where water slightly cooler. A research program for Conn Valley Reservoir or Stevens Creek Reservoir suggested and outlined.

Notes on Hardhead Control in the East Fork of Russian River, Mendocino County, California. Submitted November 17, 1947. 9 pp., map and 3 figs.

Abstract: Described the drainage of Potter Valley, a series of erosion control check dams in the valley, and the distribution of fishes in the waters. Apparently Hardhead (*Mylopharodon*) are either present as resident, nonmigratory populations above a 7-foot 6-inch barrier or are able to surmount the obstacle during their spawning migration. Additional studies to clarify this problem are suggested.

The Fishery of Clear Lake, Lake County, California. Submitted March 15, 1948. 60 pp., 10 figs., Tables I-XXII, App. 1, Exhibits A and B, App. II, Tables A-G.

Abstract: General report on investigation of Clear Lake 1946-1947. Includes descriptive material on Clear Lake, growth rate studies of important fishes, analysis of the commercial and sport catch of Clear Lake, history of the fishery, description of a closed season experiment, and a discussion of the rough fish population of Clear Lake. * * * The populations of fishes in Clear Lake are in a healthy condition and are not suffering from overfishing. The sport catch consisting of 70 percent catfish, 10 percent LMB, 10 percent BCR, and 10 percent BG, remained relatively stable 1936 to 1944. The 1946 catch was off about 40 percent, apparently correlated with a decline of rough fish population, indicating that game fish had decreased in numbers when their supply of forage decreased. * * * Closed season experiment indicated that LMB will respond favorably to protection during spawning, in terms of numbers of young produced. * * * In order to bring Clear Lake into full production, it will be necessary to increase the forage fish supply. Differential protection applied to LMB should increase their percentage of the total population, probably at the expense of competing species such as white catfish and crappie.

MURPHY, Garth I., and CHANDLER, Harry P.

The Effect of TDE on Fish and on the Plankton and Littoral Fauna in Lower Blue Lake, Lake County, California. Submitted June 25, 1948. 33 pp., 2 figs.

Abstract: Lake was treated by the Department of Agriculture with TDE in a Xylene-Triton emulsion November 7, 1947, at the rate of 1 part to 45 million to rid it of the Clear Lake gnat *Chaoborus astictopus* D & S. Daily samples of water, plankton and fish were taken by Division of Fish and Game and other observations made for five days before and seven days after the treatment with an occasional sample during the next two months to determine the effect on fish and fish food organisms. The insect and crusteacea fauna was so greatly reduced that it is doubtful that the fish could maintain themselves. After six weeks some species of crusteacea gained former numbers (not volume). Large numbers of black crappie (the most abundant fish) were killed. Experiments were carried out to determine the relative toxicity of different concentrations of various insecticides on three species of fish. The gnat was apparently eliminated according to U. S. Department of Agriculture report.

SHAPOVALOV, Leo

Report on Fisheries Resources in Connection With the Proposed Yolo-Solano Project of the United States Bureau of Reclamation. Submitted July 5, 1946. 50 pp., incl. 20 photos, plus 1 map.

Abstract: The proposed Yolo-Solano Project of the U. S. Bureau of Reclamation is a multiple-purpose feature of the Central Valley Project, providing for irrigation, domestic water supply, power, salinity control, navigation, and recreation benefits. In general, it involves (1) the storage of runoff waters from Cache and Putah Creeks in Lake and Napa Counties, by means of three large reservoirs and dams and (2) diversions from the Sacramento River at Knights Landing and Lindsey Slough. Construction of reservoirs on tributaries of Clear Lake is also being considered.

The report describes the proposed project and existing conditions, prognosticates changes in the fish populations and fisheries apt to result through the construction of the project, and presents recommendations in regard to the construction and operation of the proposed works which will insure the maximum development and utilization of the waters involved as sport fishing areas.

Recommendations include initial heavy stocking of LMB in Monticello Reservoir and Putah Creek Rediversion Dam Reservoir, control of undesirable fish species above site of Indian Valley Dam and subsequent stocking of RT in Indian Valley Reservoir and screening and maintenance of flows where needed.

SOULE, Scott M.

Poisoning Shaver Lake, Fresno County, California. Report No. 1. Investigation as to Conditions Necessary and Feasibility. Submitted April 22, 1947. ii plus 19 pp., incl. 1 fig. and 3 tables.

Abstract: Gives general description of Shaver Lake, including brief summary of Southern California Edison Company hydro-electric development on San Joaquin River. Mentions possibilities of controlling poisoned water with outlet diversion closed and with outlet diversion flowing (depending on dilution to prevent fish loss below). Lists conditions necessary for poisoning. Discusses feasibility and concludes poisoning is feasible only if Edison Company will make a special effort to control the lake to provide conditions necessary for the poisoning.

An Analysis of Trout Scales From Conn Valley Reservoir, Napa County, 1947. Submitted April 25, 1948. 14 pp.

Abstract: Scales from 99 of the 2,980 rainbow trout checked at the reservoir May 1-4, 1947, were analyzed on the basis of scale pattern, circuli count to first check or break, and scale and fish measurements. It was concluded that 30 of the 99 RT consisted of hatchery fish from the initial plant of 100,000 RT fingerlings April 1946; and that between 625 and 1,192 of the 2,980 fish checked were from this plant.

VESTAL, Elden H.

A New Transplant of the Piute Trout (*Salmo clarkii seleniris*) From Silver King Creek, Alpine County, California. Submitted September 15, 1946. 11 pp., 1 fig., appendix.

Abstract: Survey of the North Fork of Cottonwood Creek, in southeastern Mono County, revealed its possibilities for a new and remote sanctuary for the Piute trout, whose numbers have recently been reduced in its native Fish Valley, Alpine County, by poaching. During separate trips into Upper Fish Valley, Piute trout for a transplant were located and captured; and on August 23, 1946, 403 fish of all sizes (1¾ to 10 inches) were planted in a selected section of the North Fork of Cottonwood Creek. Recommendations for management of the sanctuary are given. In an appendix several recommendations are given for the management of Upper Fish Valley.

Report on Fertilization Test With Lower Virginia and Trumbull Lakes, Mono County, California. Submitted November 25, 1946. 11 pp., 4 tables.

Abstract: Lower Virginia Lake, of 12.3 acres located nine miles west of Conway Summit, California, at an elevation of 9,250 feet, was fertilized at the start of the growing season with 1,700 pounds of an 8-8-4 commercial fertilizer along with 6.41 liters of liquid trace elements. Trumbull Lake with similar characteristics and located 0.4 miles away, was not fertilized and was used for comparison in the fertilization test. At the end of the growing season there had been a greater growth and increase in plant life and plankton (by 26 times in volume of catch) in the fertilized lake.

Creel returns from Crowley Lake, Mono County, California, 1946. Submitted March 1, 1947. 7 pp., 1 fig., 2 tables.

Abstract: A creel count was made at Crowley Lake, which has a surface area of 5,284 acres and a maximum depth of 114 feet, by the Bureau of Patrol. During a season of 75 days, 13,181 anglers caught a total of 21,905 fish. Twenty thousand nine hundred eight (95.5 percent) were rainbow; 859 (3.9 percent) were brown trout, and 138 (0.6 percent) were Tahoe cutthroat. The total recorded catch weighed 33,242 pounds, indicating a yield of about 6.2 pounds per surface acre. The average catch per angler per hour for the season was 0.26. Recorded catch is estimated at little more than 50 percent of total.

Creel Returns From Crowley Lake, Mono County, California, 1947. Submitted September 1, 1947. 6 pp., 2 tables.

Abstract: A creel count at Crowley Lake was conducted by the Bureau of Patrol during the periods May 1-7 and July 2-7, 1947. During the 13 days of census 3,364 anglers fished 22,089 hours and caught 4,376 fish, including 4,143 rainbow (94.4 percent), 203 brown trout (4.6 percent), and 30 Tahoe cutthroat (less than 1 percent). Over a similar period of 13 days in 1946, 3,832 anglers fished 23,981 hours and caught 7,943 fish, including 7,495 rainbow (94.3 percent), 382 brown trout (4.8 percent), and 66 Tahoe cutthroat (less than 1 percent). Several recommendations are given for changes in fisheries management at Crowley Lake.

Report on the Creel Census at Rush Creek Test Stream, Mono County, California, 1947. Submitted November 15, 1947. 16 pp., 4 tables, 2 figs., 4 pls. (8 photos).

Abstract: Rush Creek Test Stream, 3.7 miles long, tributary to Mono Lake, was opened for creel survival studies on summer and late fall-planted catchable trout on May 1, 1947. Pre-census fish present in the stream were brown, rainbow, and eastern brook trout; no browns were planted after 1941 and the eastern brook have not been planted. From May 13 to August 4 five spaced summer test plantings were made in the stream of 2,000 catchable (average seven inches) rainbow trout each, all marked LV; on September 22d, the first winter carryover plant of 4,000 rainbow trout (average four and one-half inches) was made. Fish were of two groups, 2,000 each, from 1946-1947 fall-spawned eggs (marked Rv and AD) and from 1947 spring-spawned eggs (marked LV and AD). During the 1947 season of 184 days, 5,778 anglers fished 19,569 hours for 10,360 marked and unmarked trout. Marked 1947 planted fish contributed 87 percent of the catch. Out of the

FIGURE 23. Anglers on Rush Creek test stream, Mono County, May 2, 1948

10,000 LV trout planted, 8,881 (88.8 percent) were caught in 172 days of fishing; 7,020 of these were taken by July 31st. Unmarked fish contributed 13 percent of total catch for 1947; and 1,104 were browns, 214 rainbow, and 33 were eastern brook. Average catch per angler hour for the season was 0.52. Per mile use of the stream in 1947 is discussed.

Report of Aquatic Plant Control at Twin Lakes, Mammoth, Mono Co., California. Submitted December 8, 1947. 13 pp., 1 tbl., 6 figures (5 photos).

Abstract: The two lower Twin Lakes over a period of years had become obstructed by dense aquatic plant growth, chiefly *Anacharis*. The main portion of the center lake (12.7 acres) and the lower lake (9.4 acres) were each treated with 700 pounds of sodium arsenite, with 75 percent arsenious oxide, mixed with water and applied as spray. Effective initial concentration for the center lake was 2.6 p.p.m. and 4.0 p.p.m. for the lower lake. Collapse of plant growth reopened the entire 12.7 acres treated in the center lake nearly a month after treatment; and by onset of winter freezeover two and one-half weeks after treatment in the lower lake, 7.7 of the entire 9.4 acres had been reopened by similar collapse. Fish loss was negligible. Since sodium arsenite will not control or eliminate aquatic vegetation permanently, periodic treatment of the Twin Lakes, important for angling and recreation, may be necessary.

VESTAL, Elden H. and LEWIS, Robert C.

Report on Airplane Fish-planting Tests in Mono County, California. Submitted August 12, 1946. 8 pp.

Abstract: Using division plane, tests were conducted with CT 50-ounce, RT 10-ounce, 3-ounce, 6- to 8-pound, and with four brood fish from Hot Creek Hatchery. Fish were dumped directly, dropped in containers with and without lid, and in containers slung from a canopy cargo chute. Heights of release varied from 25 feet to 1,000 feet, with most drops from 300 to about 450 feet. The average speed of the plane was about 100 miles per hour. Drops were made in the morning from 7 to 11 a.m. Free-fall planting from 300 to 400 feet seemed to be the most successful in the direct release series. Fish from 50 to three ounces survived direct release better than larger fish used. EB responded better than RT. Fish not immediately stunned swam for cover or deep water; majority of fish stunned recovered in two to five minutes. Predation (gulls) was high in first five minutes after release. Fish planted by direct release of containers were mostly killed or injured. Chute method was most successful of all tried—fish arriving at impact area in excellent condition. Repetition of tests is recommended with plane adapted for purpose, since some mortality resulted from fish striking stabilizer and tail assembly of division plane.

Report on the Second Airplane Fish-planting Tests in Mono County, California. Submitted July 30, 1947. 8 pp., 1 table.

Abstract: The second series of airplane planting tests are described and planting notes and observations are presented and discussed. Free fall planting is considered to be the method of choice for practical fish planting in High Sierra lakes. It is recommended that the Bureau of Fish Conservation proceed to have designed and equipped a plane for fish planting in the High Sierras.

WALES, Joseph H.

Summary of Activities of the Fish Screen and Ladder Crew from January 1, to October 1, 1946. Submitted October 15, 1946. 5 pp.

Abstract: A statement of the present status of fish screens in Northern California is given. The difficulties of maintaining screens and the shortcomings of fish screens are outlined. A plan to reduce the number of screens to about 30 is proposed. These must be modern and will be frequently serviced. The present status and future plans for our Northern California fish ladders are outlined. Removal of abandoned dams and natural falls has important place. Projects for 1947 are listed.

Creel Census—May 1, 1947. McCloud River Mouth, Shasta County. Submitted May 31, 1947. 4 pp., 1 table.

Abstract: On May 1, 1947, a creel census was made at the mouth of the McCloud River (both in river and in Shasta Lake). Eighty-eight shore fishermen were counted and 14 contacted. Average catch per shore fisherman was 4.6 fish or 0.9 fish per hour. Average catch for boat fishermen was 1.5 fish or 0.3 fish per hour. These figures indicate a lower catch from the boats than in the two previous years but a larger shore catch. However, the fish caught from shore in 1947 were smaller than in 1945 and 1946. The trout catch for both shore and lake fishermen in 1947 showed no improvement over 1945 and 1946 but there was improvement in a much reduced number of rough fish. No cause can be found for the smaller catch of these squawfish and hardheads.

Castle Lake Trout Investigation; 1946 Catch, and Chemical Removal of all Fish. (Siskiyou County.) Submitted June 20, 1947. 21 pp., 14 tables, 1 figure.

Abstract: In 1946, 667 anglers caught 1,275 fish from Castle Lake (0.48 per hour or 1.9 per angler day). Twenty fishermen caught over 50 percent of all fish and 57 percent of anglers caught nothing. As in previous years the BN constituted over half the catch, RT less than one-fourth and even fewer EB despite nearly equal plants of all. Lake poisoned on October 9, 1946, and all fish possible were recovered and recorded. Numbers were as follows: BN, 2,027; EB, 364 (planted in 1946); EB, 50 (planted prior to 1946; RT, 44; mackinaw, 81; black dace, several thousand; golden shiners, several hundred. Small numbers of RT recovered probably due to fact that they were in deeper water when killed and could not be recovered. Fingerlings planted prior to poisoning then recovered yielded data on mortality during critical period. Mortality of all trout planted in lake during past nine years divided as follows: 90-97 percent due to natural causes, 3 to 10 percent caught by anglers. A new method of siphoning cube liquid into deep water is described.

Creel Censuses in District 1, May 1, 1948

1. McCloud River, Mouth, 3 pp.
2. Shasta River, 3 pp.
3. Klamath River, 5 pp.

Submitted May 13, 14, and 17, 1948.

Abstract: 1. Only 28 anglers fished here May 1st, probably due to weather and road conditions. Total catch: Five RT, one BN, one "pike." The average of 0.24 fish per hour is far lower than in any of the three preceding years. No marked RT from Almanor Hatchery in catch.

2. Open May 1st from mouth five miles up for first time in several years. Eighty-six (most of the) anglers checked, known to have caught 260 SH. Catch per hour 1.37 for lower half of section, 0.79 for upper. Size range four inches to 18 inches, with 92 percent from five inches to nine inches.

3. From Fall Creek to Scott River 108 anglers (a fairly complete check) had 135 SH and one probable salmon. 0.50 fish per hour from Shasta River to Fall Creek, 0.39 from Shasta River to Scott River. Size range four inches to 18 inches, with 84 percent five inches to nine inches.

WOODHULL, Chester

A Preliminary Investigation of the Mokelumne River from Tiger Creek to Pardee Reservoir. Submitted October 8, 1946. 14 pp. plus 1 map, 3 graphs and 9 photos.

Abstract: A summary of the proposed changes of the P. G. & E. hydro system; and a physical and biological survey of the river. A new plant will be constructed, the Electra Plant is to be enlarged and a tunnel system will replace the Electra canals. Regulating dams 18 to 22 feet high will be built at the plants. The mean flows needed by the plants exceed the mean stream flow. Because of the exposed character and low altitude of the river, a suggested minimum release of water is set at 15 c.f.s., to maintain this fine trout stream.

Spawning habits of the striped bass (*Roccus saxatilis*) in California waters. Submitted November 1946. 12 pp., 3 figures.

Abstract: Describes observations of spawning behavior of striped bass; collection of eggs; and data on location and conditions.

REPORT OF THE BUREAU OF GAME CONSERVATION

The biennium of 1946-48 has seen several major changes in the Bureau of Game Conservation which we feel have resulted in providing better service to the sportsmen who harvest the game, and to the landowners who raise it.

A reevaluation of state game refuges has been made with the result that some which have outlived their purpose have been opened to hunting while there have been boundary changes in others. Some local opposition was met in 1947 but cooperative formulation of plans for the 1948 hunting season gives indications of harmony and a common purpose.

Among the more noteworthy of the changes in the bureau has been the absorption of the former Bureau of Game Farms.

UPLAND GAME BIRD PRODUCTION

On July 1, 1946, the Bureau of Game Farms, for many years under the direction of August Bade (retired from state service in 1946), was dissolved and the work put under the direction of the Bureau of Game Conservation. Mr. Carlisle Van Ornum, Supervisor of Game Farms, has bent every effort to make the former Bureau of Game Farms fit into the

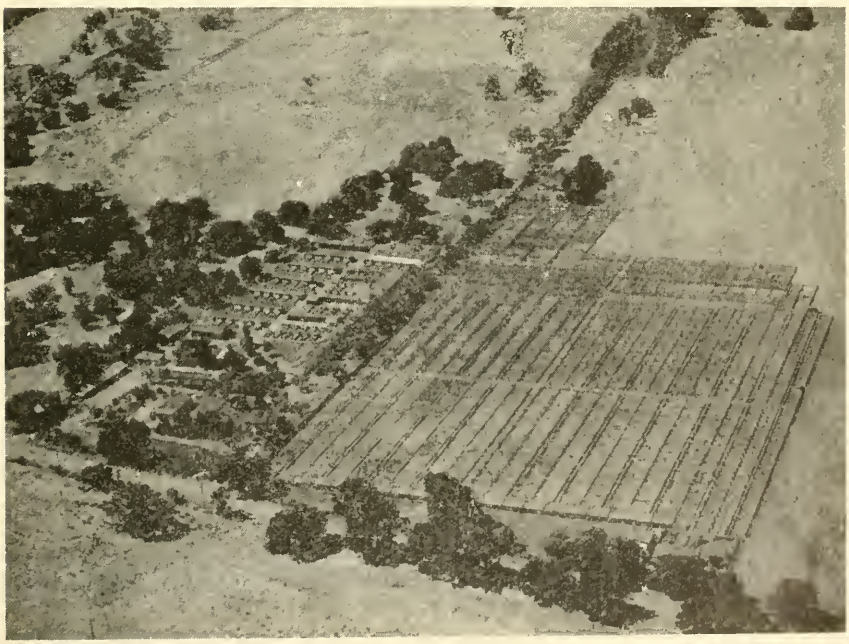


FIGURE 24. Aerial view of the Yountville Game Farm, heart of the division's game farm system, supplies eggs and young birds to other Bureau of Game Conservation installations and more than a score of sportsmen's club holding pens

present set-up in order that all agencies dealing with upland game birds will pursue a unified policy.

Several game farm units, authorized by the Legislature during the war years but uncompleted due to material shortages, were put into production. Among these were units at Marysville, Chico, Los Banos, Porterville, and Brawley.

During the years January 1, 1946, to December 31, 1947, the state units and sportsmen's pens raised and liberated 115,632 upland game birds. Of this number, 102,233 were ring-necked pheasants (38,697 were raised in sportsmen's pens), 1,278 were Reeves pheasants, 11,066 Chukar partridges, 702 valley quail and 353 wild stock turkeys. A summary of the liberation of game birds will be found in the appendix, page 106. Of the above pheasants, 30,546 were banded. Bands returned by hunters totaled 1,842, or 6.03 percent. About the same number of females were banded to facilitate the field study of this species.

As directed by the Fish and Game Commission, all Chukar partridges in Northern California game farm units were taken to Southern California in the early spring of 1947, and Chukar raising discontinued north of the Tehachapi Mountains. Several Chukar coveys are well established in Owens Valley, Inyo County.

In the spring of 1947 we sent to the State of Arizona 500 pheasant eggs and 200 Chukar partridge eggs for which we hope to get wild turkeys.

In the fall of 1946 a number of changes were made in the personnel of the production farms. The superintendent at Yountville was transferred to the division's headquarters in San Francisco, the superintendent at Chino was moved to Yountville, the superintendent at Fresno moved to Chino (the superintendent position being abolished at Fresno), and the foreman at Chino moved to Fresno. These necessary changes adversely affected our production temporarily in that the experienced men arriving at their new positions had to learn their districts, the men under them, and the peculiarities of the equipment they had to handle.

GAME MANAGEMENT AREAS

The game management area plan, initiated in California by the 1939 State Legislature, was an effort to stimulate the landowner's interest in the game crop. It was intended to foster and increase the supply of upland game through private management of the land for game production, and by restocking with privately raised birds. This production of additional shooting is made economically possible by hunters of sufficient means paying extra for a longer season taking both sexes, and a bigger legal bag than it is possible to supply to the general hunting public.

During the 1946 season there were 10 operators who controlled 23,263 acres. These operators liberated 2,918 pheasants and 85 valley quail and killed 1,820 pheasants (927 males and 893 females) and 99 valley quail (61 males and 38 females).

As the valley quail were released in the spring, the operators were allowed to take more than they liberated. Hunting took up 1,021 man-days. The season was not particularly successful as all areas were commercial and the operators found it difficult to control the public on their land.

The following year the State Legislature modified the law and allowed noncommercial areas where the public was excluded. The number of commercial areas dropped to one and the noncommercial areas increased to 24. As noncommercial areas were limited to 2,500 acres the total acreage was not as large in proportion to the number of areas as in the previous year.

During the 1947 season there were 25 operators who controlled 32,828 acres. These operators liberated 7,337 pheasants and killed 3,896 (1,960 males and 1,936 females). We were able to inspect, check and control these areas much better in 1947 than in 1946 and found that 28 percent of the birds taken had game management area bands on their legs. Hunting took up 1,919 man-days.

The season was successful from the standpoint of the operators and their guests. Quite a number of areas were operated by hunting dog men for the purpose of training dogs and allowing dog owners to hunt and work their dogs. Of the 25 operators, only six shot over 90 percent of the allowable 70 percent of the birds liberated.

PREDATOR CONTROL

During the biennium a grand total of 8,574 coyotes and 2,653 bobcats were taken by our predatory animal hunters and trappers.

A total of 4,943 other lesser predators were taken during the same period. A summary of the predators taken during the biennium will be found in the appendix, page 105.

MOUNTAIN LION CONTROL

A total of 219 mountain lions were taken during the calendar year of 1946, and 195 in the calendar year of 1947 for a grand total of 414 mountain lions during this two-year period.

Of the 414, 99 were taken by state lion hunters and 315 were taken by private persons. It is pointed out that the state lion hunters operate where there have been complaints by stock ranchers and that they get into country that is generally inaccessible to the general public. A summary of the mountain lions taken from 1907 through 1947, inclusive, will be found in the appendix, between pages 104-105.

GAME MANAGEMENT DISTRICTS

During the biennium this most important phase of habitat and game population control has been set up on a district basis. These districts and the corresponding game managers in charge are as follows: South Coast Counties, Mr. D. M. Selleck; Southern California, Mr. J. Laughlin; Northeastern California, Mr. J. D. Stokes; Central Valley,

Mr. L. H. Cloyd. It is the responsibility of each game manager to investigate game problems and apply corrective measures within his district and to administer bureau installations. Work being accomplished includes depredation control in conjunction with the Bureau of Patrol; operation of winter deer ranges, elk refuge, waterfowl refuges, and waterfowl management areas; trapping and transplanting upland and big game; inspection of game management area operations; development of quail and other upland game habitat. Game Manager R. E. Curtis acts in a supervisory and advisory capacity to the district game managers, integrating their efforts into a common program.

CALIFORNIA FISH AND GAME LANDS
(Other Than Game Farms)

Tehama Deer Winter Range with 28,589.60 acres (additional purchases pending) was purchased from 1943 to 1948, inclusive, to protect the winter range from natural food depletion by heavy stock-grazing.

Doyle Deer Winter Range with 11,700 acres was purchased in 1948.

Honey Lake Waterfowl Management Area (including Biscar Reservoir) with 3,519.70 acres was purchased from 1942 to 1944, inclusive.

Imperial Waterfowl Management Area with 535.24 acres (additional purchase pending) was purchased in 1948.

Madeline Plains Waterfowl Management Area with 4,776.10 acres was purchased in 1945-46.

Gray Lodge Waterfowl Refuge with 2,541.51 acres was purchased in 1931-32.

Imperial Waterfowl Refuge with 2,064.43 acres was purchased in 1931-32.

Los Banos Waterfowl Refuge with 3,000.00 acres was purchased in 1929.

Suisun Waterfowl Refuge with 1,887.00 acres was purchased in 1932.

FEDERAL AID IN WILDLIFE RESTORATION
(PITTMAN-ROBERTSON)

This program has expanded greatly during the biennium and the return to the sportsman and game administrator is and shall continue to be of practical usability. Although some equipment and materials were still scarce, surveys and investigations, development, and land acquisitions proceeded at an accelerated rate.

For the fiscal year, 1946-47, California received a federal aid in wildlife restoration apportionment of $103,132.34 and for the year 1947-48, $374,283.09. California's contribution, as required by the act, brought the total available for expenditure during the biennium to $636,453.91.

A total of 14 projects was in operation during all or part of the biennium. Of these, eight were of the surveys and investigations category, three were development projects, two provided for the acquisition of

lands, and one coordination project facilitated land acquisition and coordinated the efforts of the state departments concerned. Following is an account of the various projects which have been undertaken:

Surveys and Investigations

Project 24-R, a survey of reported critical deer ranges in California, was begun in 1946 and completed June 30, 1947. The final report was completed and submitted to the U. S. Fish and Wildlife Service. The results of this study are being utilized by the present Project 28-R. The project was initially led by Mr. J. F. Ashley, who was transferred to other duties in 1946. The survey was then taken over and carried to completion by Mr. H. A. Hjersman.

Project 19-R, the study of the life history and management of mountain quail in California, began in 1946 and is being continued. This project was led by Mr. R. W. Enderlin, who resigned in 1947. The leader since that time has been Mr. E. V. Miller.

Project 20-R, a survey of waterfowl food plants of California, began in 1946 and is being conducted under contract with the University of California. The leader is Dr. H. L. Mason, University Herbarium.

Project 22-R, the life history and management of the ring-necked pheasant in California, began in 1945 and is begin continued. This project has been led by Mr. F. M. Craig (resigned, 1946) and Mr. H. W. Twining (resigned, 1948). The present project leader is Mr. C. M. Ferrel.

Project 25-R, a study of the food habits of California game birds and mammals and species affecting their welfare, began in 1946 and is being continued. The project leader is Mr. D. F. Tillotson.

Project 28-R, a study of deer population and management problems in California, began in 1947 and is being conducted under contract with the University of California. The leader is Dr. A. S. Leopold of the University Museum of Vertebrate Zoology.

Project 30-R, a study of production, migration, and wintering areas of waterfowl in California, began in 1948 and is continuing under the leadership of Mr. J. E. Chattin.

Project 31-R, a study of the effects of brush removal on game ranges in California, began in the latter portion of the biennium and is being conducted under contract with the University of California under the leadership of Dr. H. A. Biswell of the School of Forestry.

Development Projects

Project 18-D, the live-trapping and transplanting of beaver, commenced in May, 1945, was still in operation at the close of this biennium. One additional trapping and transplanting crew was added in 1948 and, to date, the two crews have trapped and liberated 337 beaver at 84 locations. This species is proving popular with forest officials and others desirous of improving stream habitat and grazing lands. The project leader is Mr. A. L. Hensley.

Project 27-D involved the repair of Tule Lake Dam and construction of diversion works to provide water for the ponds of the Madeline Plains Waterfowl Management Area. The work was performed and completed

during the fall and winter of 1946-47 by the Division of Water Resources, Department of Public Works, for the Division of Fish and Game.

Project 26-D, working on the restoration of the various species of quail in California, represents the major effort in habitat development. This program has developed as a result of experimental work performed by project 6-R. During the biennium about 150 "gallinaceous guzzlers," or rain catchment aprons with underground cisterns and access ramps, were constructed primarily to provide water for thirsty quail. Many acres of habitat unsuitable because of lack of water are now producing thousands of additional quail for California's hunters. Much of this construction received financial aid from county fine moneys and physical aid from sportsmen and other interested persons.

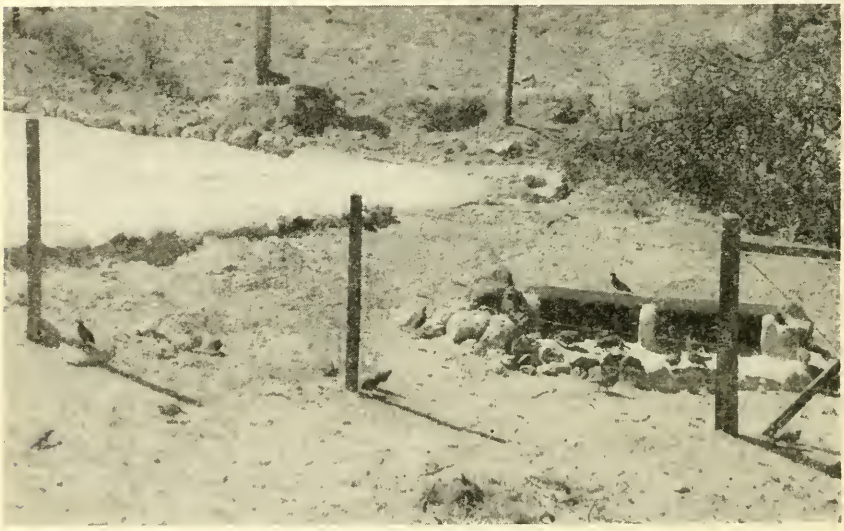


FIGURE 25. View of "gallinaceous guzzler" showing use by valley quail (San Benito County)

The majority of this work was accomplished by one crew under the leadership of Mr. F. T. Ross. At the close of the biennium three separate "guzzler" crews were operating with one additional crew authorized. These watering devices were being produced at the rate of 15 to 20 each month.

DISEASE LABORATORY

The disease laboratory, a bureau function located in Strawberry Canyon on the campus of the University of California in Berkeley, has expanded its program but the working space is inadequate. Under the direction of Dr. C. M. Herman the staff discovered pullorum, a serious intestinal disease, among the state game farm pheasants in the spring of 1947. That fall an extensive control program was initiated with the result that the disease was eradicated. An outbreak of infectious coryza was found in one of the game farm units and the disease was eradicated.

FIGURE 26. The recently acquired mobile wildlife laboratory operated by the Bureau of Game Conservation is equipped for on-the-spot investigations and autopsies in the field. Speedy diagnosis of wildlife diseases enables the division to inaugurate control measures without delay

Investigation of reported hoof and mouth disease in deer in several local outbreaks disclosed the disease to be foot-rot. Work on this is being continued as cases occur. This was an infection caused by anaerobic bacteria produced in waterholes which were at a low level because of scant rainfall.

Many other studies were in progress at the close of the biennium and outbreaks of game diseases were investigated both in the field and the laboratory upon their occurrence.

BEAVER TRAPPING

Owing to the increase of the beaver population in the delta area of the Sacramento and San Joaquin Rivers, an area in excess of 1,500 miles of waterways was opened to the commercial trapping of beaver from November 15, 1947, until the last day of February, 1948. One hundred nineteen special permits were issued to licensed trappers of which 86 participated. The revenue received by the trappers for 842 of the 975 beaver trapped was $14,270, or an average of $16.95 per pelt. This is one example of the long-range management plan of the bureau in harvesting the surplus over and above the balance between population and habitat.

FIGURE 27. View of beaver dam established by transplanted beavers (Tuolumne County)

BIG GAME TRAPPING

The biennium has experienced an expanded program of manipulation of big game populations. In an attempt to create new centers of game populations for eventual harvesting by sportsmen in presently unoccupied habitat, requests for moving big game were made by sportsmen, the Division of Parks, and the Fish and Game Commission. Although this management tool is relatively new in California and the procedure expensive, the following trapping and transplanting was accomplished:

Antelope—38 head were trapped at Mud Flat, Lassen County, of which 32 survived the transport, and were liberated near Mono Lake, Mono County, in 1947.

Elk—17 head were trapped at the Prairie Creek Redwoods State Park near Orick, Humboldt County, and were liberated in Bear Valley, Del Norte County, in 1947.

Deer—About 40 head were trapped in Capay Valley, Yolo County, and liberated in the Livermore Hills area in several counties.

One of the lengthiest hauls of trapped deer in history involved the movement of 49 deer from Lassen County to the Providence Mountains of San Bernardino County.

REPORT OF BUREAU OF LICENSES

As the Division of Fish and Game is a self-supporting state agency, the responsibility of the Bureau of Licenses is to manage the printing and distribution of licenses as well as collecting all moneys received from the sale of licenses. In all there are 19 kinds of licenses bringing a yearly revenue of approximately $4,589,900. The principal licenses are: Hunting, angling, deer tags, and market fishermen.

As the law provides that a license is required to hunt or fish, the bureau maintains approximately 2,800 agencies throughout the State so that the sportsmen may purchase their licenses as conveniently as possible.

For the purpose of license management and distribution the State is divided into five districts, each district office maintaining the necessary records to enable them to control the distribution and sale of licenses to the agents within their respective districts. Branch district offices are maintained at Redding, Sacramento, San Francisco, Fresno and Los Angeles.

All license distribution is conducted on a consignment basis, the agent being bonded in an amount sufficient to cover his accountability at any one time. During the last seven-year period the bond premiums have been reduced from $5 to $1.75 per 1,000. This reduction in the premium rate is the result of close supervision of our license agents' accounts and keeping the losses or claims filed with the bonding company to a bare minimum. During this seven-year period the bonding company has paid seven claims, totaling $561.63. The license sales accounted for during this period amounted to $14,587,000.

The law placing all license distribution on a credit basis, which went into effect in January, 1946, has proved very satisfactory and has eliminated any shortages in the field. During the biennium several changes were made in the license laws, establishing certain new licenses and changing the fees of other licenses. In 1946 the "Archery Hunting and Archery Deer Tag Law" became effective.

The sale of archery licenses and tags for the years 1946 and 1947 are as follows:

Archery

Year	*Hunting*	*Deer tags*
1946	$663	$604
1947	681	590

Other changes in the license fees are as follows:

Hunting

	Old fee	*New fee*
Citizen resident	$2	$3
Junior citizen	1 over 18 years	1 over 16 years
Nonresident	10	10 minimum reciprocal
Declarant alien	10	Abolished
Alien	25	50
Veteran's wife	None	2

Angling

	Old fee	*New fee*
Citizen resident	$2 over 18 years	$3 over 16 years
Junior citizen	None under 18 years	None under 16 years
Nonresident	3	5 minimum reciprocal
Alien	5	25

DEER MEAT PERMITS

All persons retaining deer meat in their possession after the regular 15-day period following the close of deer season are required to have the meat stamped. The fee for stamping and retaining the deer meat is $1. Deer meat permits, stamps, etc., are furnished to all locker plants and other places where deer meat may be kept. These places of business stamp the meat and are permitted to retain 50 cents for their services, and account to the Division of Fish and Game for the other 50 cents. The revenue for the years of 1946 and 1947 was as follows:

1946	$11,881
1947	11,965

The Fish Packer's and Shellfish Dealer's License Act was amended in 1947. As amended the new act provides that all dealers in fresh fish are required to be licensed. This new law went into effect on September 19, 1947.

License agents are now permitted by law to retain their 5 pereent compensation at the time of remitting for license sales. This change provides the immediate payment of his commission to the agent, and eliminates considerable work in the departmental accounting office, State Controller's Office, and State Treasurer's Office.

The sale of hunting licenses, angling licenses, and deer tags has shown a large increase during the past 10 years. The following tables show the increase each year:

Hunting

Year	*Value*	*Number*	*Year*	*Value*	*Number*
1938-39	$487,763 50	252,117	1943-44	$557,254 00	284,370
1939-40	528,952 00	270,095	1944-45	626,634 00	318,910
1940-41	565,395 00	291,507	1945-46	780,106 50	393,282
1941-42	643,700 00	331,878	1946-47	965,916 00	487,307
1942-43	522,985 00	268,128	1947-48	1,016,600 50	507,068

Angling

Year	*Value*	*Number*	*Year*	*Value*	*Number*
1938	$705,611 00	348,227	1943	$899,782 00	447,352
1939	746,061 00	366,452	1944	883,841 00	436,940
1940	791,472 00	390,342	1945	1,120,661 50	557,536
1941	933,586 00	460,715	1946	1,553,706 00	768,816
1942	876,003 00	433,431	1947	1,793,368 50	884,772

Deer Tags

Year	*Value*	*Number*	*Year*	*Value*	*Number*
1938	$141,598 00	----	1943	$147,795 00	----
1939	152,924 00	----	1944	178,250 00	----
1940	163,285 00	----	1945	214,662 00	----
1941	173,699 00	----	1946	282,060 00	----
1942	116,121 00	----	1947	299,610 00	----

It will be noted that during the war years, particularly 1942, 1943, and 1944, the sales fell off somewhat. This was caused by wartime regulations. However, since 1938 the number of hunters and fishermen has increased as follows:

Hunting	101%
Angling	154%
Deer Tag	112%

APPENDIX

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT

For the Period July 1, 1946, to June 30, 1947

(Ninety-eighth Fiscal Year)

Function	Salaries and wages	Operating expenses	Equipment	Total
Administration—101				
Seasonal employees	$2,720 00			$2,720 00
Regular employees	44,121 27			44,121 27
Accident and death claims		$10,485 69		10,485 69
Automobile		7,975 93	$2,646 89	10,622 82
Educational		95 01		95 01
Exhibits		46 45		46 45
Freight, cartage and express		1,993 98		1,993 98
Legal advertising		1,601 86		1,601 86
Library		365 42	832 56	1,197 98
Light, heat and power		1,845 68		1,845 68
Office		8,987 72	869 42	9,857 14
Photography		10,740 14	658 19	11,398 33
Postage		7,371 09		7,371 09
Premium on bonds		54 00		54 00
Printing, general		6,844 61		6,844 61
Printing fish and game magazine		2,394 60		2,394 60
Pro rata, attorney general services		6,000 00		6,000 00
Pro rata, departmental administration		44,451 37		44,451 37
Pro rata, general fiscal administration		29,119 63		29,119 63
Pro rata, Personnel Board services		11,454 90		11,454 90
Rent		11,724 94		11,724 94
Telephone and telegraph		10,491 01		10,491 01
Travel		9,647 92		9,647 92
Total Administration	$46,841 27	$183,691 95	$5,007 06	$235,540 28
Patrol and Law Enforcement—104				
Cannery inspection	$8,712 06			$8,712 06
Executive	32,315 13			32,315 13
Land patrol	392,925 56			392,925 56
Marine patrol	111,173 03			111,173 03
Office	45,936 32			45,936 32
Airplane		$2,383 57	$3,254 71	5,638 28
Automobile		97,077 32	83,085 69	180,163 01
Boats		15,088 60	30,209 48	45,298 08
Field		2,534 37	7,683 21	10,217 58
Freight, cartage and express		191 89		191 89
Light, heat and power		109 21	9 18	118 39
Office		690 95	2,136 25	2,827 20
Postage		265 50		265 50
Premium on bonds		2,530 04		2,530 04
Printing		1,213 54		1,213 54
Rent		9,382 93		9,382 93
Telephone and telegraph		11,438 65		11,438 65
Travel		105,996 33		105,996 33
Radio			9,212 94	9,212 94
Total Patrol and Law Enforcement	$591,062 10	$248,902 90	$135,591 46	$975,556 46
Marine Fisheries—105				
Central Valley water project and salmon study	$33,808 39			$33,808 39
Executive	10,727 00			10,727 00
Laboratory	10,950 80			10,950 80
Library	2,101 53			2,101 53
Office	12,637 79			12,637 79
Scientific investigation	28,573 55	$4,522 29	$3,357 11	36,452 95
Statistics	36,553 19	1,495 13	459 88	38,508 20
Automobile		5,652 07	9,635 81	15,287 88
Cooperative research		16 58		16 58
Fish cannery auditing		5,573 34		5,573 34
Fish specimens and tagged fish		201 78		201 78
Fish tags		947 06		947 06
Laboratory		1,156 15	317 89	1,474 04
Library		221 95	339 05	561 00
Light, heat and power		664 65		664 65
Office		454 90	510 39	965 29
Postage		849 39		849 39
Printing		4,493 57		4,493 57
Freight, cartage and express		1,254 97		1,254 97
Rent		6,129 63		6,129 63
Telephone and telegraph		323 01		323 01
Travel		13,405 77		13,405 77
Total Marine Fisheries	$135,352 25	$47,362 24	$14,620 13	$197,334 62

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1946, to June 30, 1947

(Ninety-eighth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
Fish Conservation—106				
Biological survey	$39,401 03			$39,401 03
Executive	17,336 50			17,336 50
Field supervision	28,379 75			28,379 75
Fish rescue	8,869 21			8,869 21
Office	10,943 66			10,943 66
Pollution inspection	3,499 99			3,499 99
Stream improvements	6,196 15			6,196 15
Basin Creek	7,704 60			7,704 60
Benbow Dam	2,065 30			2,065 30
Brookdale	8,016 82			8,016 82
Burney	8,665 41			8,665 41
Central Valley	10,602 12			10,602 12
Coy Flat	116 24			116 24
Fall Creek Hatchery	6,770 14			6,770 14
Feather River	6,388 64			6,388 64
Fillmore Hatchery	27,576 20			27,576 20
Hot Creek Hatchery	21,243 46			21,243 46
Huntington Lake	333 13			333 13
June Lake Egg Collecting Station	198 38			198 38
Kaweah Hatchery	7,324 96			7,324 96
Kern Hatchery	3,674 91			3,674 91
Kings River Hatchery	8,028 55			8,028 55
Lake Almanor Hatchery	10,216 57			10,216 57
Mad River Egg Collecting Station	1,055 47			1,055 47
Mojave River Hatchery	1,271 00			1,271 00
Mt. Shasta Hatchery	61,796 62			61,796 62
Mt. Tallac Hatchery	5,152 11			5,152 11
Mt. Whitney	30,738 20			30,738 20
Prairie Creek Hatchery	8,024 23			8,024 23
Sequoia Hatchery	5,939 36			5,939 36
Shasta River Hatchery	488 57			488 57
Snow Mountain	1,038 87			1,038 87
Tahoe Hatchery	7,667 40			7,667 40
Tuolumne	858 67			858 67
Whittier Hatchery	10,872 28			10,872 28
Yosemite Hatchery	6,779 86			6,779 86
Yuba River Hatchery	4,352 28			4,352 28
Automobile		$37,656 19	$49,894 97	87,551 16
Chemicals		4,832 52		4,832 52
Eyed eggs		1,546 81		1,546 81
Field operating supplies		11,403 71	2,553 32	13,957 03
Fish foods		155,439 97		155,439 97
Freight, cartage and express		8,338 58		8,338 58
Fuel		3,762 76		3,762 76
Ice		3,590 73		3,590 73
Light, heat and power		11,524 19		11,524 19
Office		662 80	25 16	687 96
Operating expenses		114 89	21,836 46	21,951 35
Operating service		187 86		187 86
Postage		481 24		481 24
Printing		1,045 75		1,045 75
Rent		22,672 08		22,672 08
Structural maintenance		7,669 45	923 49	8,592 94
Telephone and telegraph		2,130 25		2,130 25
Travel		23,463 48		23,463 48
Statistics			16 37	16 37
Total Fish Conservation	$389,586 64	$296,523 26	$75,249 77	$761,359 67
Game Conservation—108				
Brawley Game Farm	$964 44			$964 44
Castaic Farm	2,708 64			2,708 64
Elk Refuge	3,057 48			3,057 48
Executive	15,876 93			15,876 93
Fresno Game Farm	9,467 40			9,467 40
Game bird district—Los Serranos	410 40			410 40
Game management	47,242 21			47,242 21
Gray Lodge Refuge	8,478 16			8,478 16
Honey Lake Refuge	9,050 76			9,050 76
Imperial Refuge	5,037 66			5,037 66
Los Banos Refuge	5,786 64			5,786 64
Los Serranos Game Farm	19,406 63			19,406 63
Porterville Game Farm	1,661 44			1,661 44
Predatory animal lion hunting	12,976 72			12,976 72
Predatory animal trapping	76,497 23			76,497 23

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1946, to June 30, 1947

(Ninety-eighth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
Game Conservation—108—Continued				
Redding Game Farm	$5,261 90			$5,261 90
Research	15,778 88			15,778 88
Sacramento Game Farm	5,182 28			5,182 28
Suisun Refuge	4,642 72			4,642 72
Valley Center	1,959 66			1,959 66
Visalia	318 06			318 06
Willows Game Farm	3,264 01			3,264 01
Yountville boarding house	2,133 07			2,133 07
Yountville Game Farm	35,278 38			35,278 38
Airplane rental		$9 99		9 99
Automobile		47,034 11	$43,014 24	90,048 35
Bounties		11,538 60		11,538 60
Cooperating in game management school		187 70	40 79	228 49
Field		33,020 61	1,851 50	34,872 11
Game foods		25,225 34		25,225 34
Freight, cartage and express		118 76		118 76
Laboratory		3,177 27	1,771 48	4,948 75
Light, heat and power		7,758 81		7,758 81
Office	10,004 76	443 21	794 19	11,242 16
Postage		174 00		174 00
Printing		1,167 20		1,167 20
Rent		4,709 69		4,709 69
Statistics		1,381 88		1,381 88
Telephone and telegraph		1,200 09		1,200 09
Travel		27,311 09		27,311 09
Total Game Conservation	$302,446 46	$164,458 35	$47,472 20	$514,377 01
Licenses—111				
Executive	$9,336 00			$9,336 00
License distribution	24,332 79			24,332 79
Automobile		$1,023 37	$900 21	1,923 58
Freight, cartage and express		2,318 42		2,318 42
License commissions—credit agents		150,453 85		150,453 85
License commissions—cash agents		439 21		439 21
Office	2,600 90	524 95	1,192 27	4,318 12
Postage		6,675 78		6,675 78
Premium on bonds		7,245 15		7,245 15
Printing		42,901 11		42,901 11
Rent		780 00		780 00
Telephone and telegraph		248 55		248 55
Travel		1,630 71		1,630 71
Total Licenses	$36,269 69	$214,241 10	$2,092 48	$252,603 27
Construction of Fish Screens and Stream Improvements				
Total Fish Screens		$4,402 80		$4,402 80
Total Fish and Game Support—Ninety-eighth Fiscal Year				$2,941,174 11
Less estimated maintenance deductions				13,312 92
Net total for support—Ninety-eighth Fiscal Year				$2,927,861 19

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1946, to June 30, 1947

(Ninety-eighth Fiscal Year)—Continued

Function	Detail	Total
Additions and Betterments		
Purchase of land		
Appraisal of the Welch tract in Colusa County	$323 69	
Acquisition, establishment and maintenance of fish hatcheries (chapter 1439-45)		
Los Angeles County	7,694 23	
San Bernardino County	23,684 12	
Total Land		$31,702 04
Improvements		
Alterations to botanical gardens building, Game Conservation—		
Research laboratory	$3,050 29	
Alterations and modernization of hatchery buildings	8,192 85	
Brooder houses and pens:		
Redding game farm	35 63	
Sacramento game farm	132 41	
Yountville game farm (chapter 644-45)	4,647 05	
Yountville game farm (chapter 106-46)	71 76	
Brookdale hatchery—propane installations	1,128 00	
Central Valley hatchery	682 78	
Coast counties quail project—warehouse	1,363 17	
Construction of rearing ponds (all hatcheries)	127 55	
Construction and equipment of workman shop and warehouse at Yreka	3,763 73	
Construction of salmon traps in Central Valley and Trinity River watersheds	1,680 68	
Crystal Lake hatchery	117,503 54	
Crystal Lake hatchery—cattle guard fence	11,000 00	
Engineering project	10,000 00	
Experimental electrical and mechanical fish screens	9,789 94	
Fern Creek—house and garage remodeling project	119 21	
Fish ladders and dams:		
Clough Dam on Mill Creek	8,000 00	
Woodbridge Dam	65,400 00	
Game refuges (miscellaneous)	6,354 01	
Game farms (miscellaneous)	4,248 93	
Hot Creek hatchery	3,699 50	
Honey Lake refuge	597 14	
Imperial public shooting grounds	1,633 83	
Improvements of game farms:		
Brawley	5,481 32	
Chico	5,649 18	
Marysville	4,509 71	
Porterville	8,459 63	
Improvements to Tule Lake and Madeline reservoirs	10,615 38	
Kern hatchery—drilling of well	461 79	
Kern hatchery	1,410 81	
Mt. Tallac hatchery	63 88	
Mt. Whitney hatchery—wire installations	850 00	
Tahoe hatchery—new construction	4,317 23	
Prairie Creek hatchery—propane installation	1,955 19	
Redding game farm—cottage and garage	5,644 39	
Redding warehouse	483 36	
Refrigeration facilities:		
Central Valley hatchery	5,271 87	
Crystal Lake hatchery	2,727 81	
Fillmore hatchery	2,559 04	
Kern hatchery	2,621 54	
Mt. Whitney hatchery	5,382 14	
Sequoia hatchery	2,660 40	
Remodeling of living quarters:		
Fresno game farm	501 23	
Sacramento game farm	52 10	
Replacement of pipe lines (all hatcheries)	794 17	
Tahoe hatchery (miscellaneous)	371 93	
Tehama winter range	8,452 91	
Terminal Island laboratory	4,500 00	
Terminal Island parking area—paving	760 00	
Tuna fisheries research facilities	640 63	
Total Improvements		$350,419 64
Total Additions and Betterments		$382,121 68

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1946, to June 30, 1947

(Ninety-eighth Fiscal Year)—Continued

Function	Detail	Total
Cooperation with Federal Government—Pittman-Robertson Act		
Beaver transplanting state-wide	$4,821 82	
Restoration of valley quail in south coast ranges of California	20,323 50	
Repair of Tule Lake Reservoir Dam (Part 1, all) and Tule Lake Reservoir Diversion Works (Part 2, segment 1)	62,265 00	
Madeline Plains waterfowl management area	1,440 00	
Desert game water development survey	334 18	
Life history and management of mountain quail in California	13,212 70	
Survey of the waterfowl food plants of California	2,450 81	
Life history and management of the ring-necked pheasant in California	12,831 08	
Survey of critical summer and winter deer ranges of California	6,811 59	
Study of food habits of the mountain quail, ring-necked pheasant and coyote of California	10,822 22	
Total Pittman-Robertson Act		$135,312 90
Less individual abatement from Federal Government pro rata share Pittman-Robertson Act		70,262 14
Net total Pittman-Robertson Ninety-eighth Fiscal Year		$65,050 76
State apportionment: Madeline Plains waterfowl management area Preliminary engineering survey (Tule Lake dam)		1,500 00
Contributed to Employees Retirement Fund		129,361 55
Grand total Fish and Game Preservation Fund—Ninety-eighth Fiscal Year		$3,505,895 18

STATEMENT OF REVENUE

For the Period July 1, 1946, to June 30, 1947

(Ninety-eighth Fiscal Year)

	Detail	Total
Revenue for Fish and Game Preservation Fund:		
1946 series		
Archery deer tags	$604 00	
Deer tags	282,053 00	
Total deer tags		$282,657 00
Fish tags	$2,569 89	
Game tags	369 51	
Market fishermen	50,090 00	
Fish importers	10 00	
Fish party boat permits	153 00	
Fish breeder	75 00	
Game breeder	190 00	
Kelp license	10 00	
Game management area licenses	10 00	
Game management area tags	53 73	
Deer meat agents—locker permits	11,285 00	
Deer meat agents—wardens	596 00	
Total 1946 series		$2,120,599 63
1945 series		
Angling		
Citizen	$5,028 00	
Non-resident (Debit)	3 00	
Duplicate	3 50	
Total angling		$5,028 50
Hunting		
Citizen	$17,454 00	
Junior	1,198 00	
Non-resident	120 00	
Declarant alien	20 00	
Duplicate	68 50	
Total hunting		$18,860 50
Deer tags	$23 00	
Fish tags	83 01	
Game breeder	90 00	
Kelp license (Debit)	70 00	
Game management area licenses (Debit)	20 00	
Deer meat agents—locker permits	12 50	
Total 1945 series		$24,007 51
Other revenue		
Court fines	$110,058 64	
Lease of kelp beds	52 80	
Fish packers tax	218,534 03	
Kelp tax	3,154 16	
Salmon tax	43,618 85	
Miscellaneous	32,333 56	
Interest on Surplus Money Investment Fund	1,429 37	
March court fines	79	
Total other revenue		$409,182 20
Grand total Fish and Game Preservation Fund		$3,556,426 26

STATEMENT OF REVENUE—Continued

For the Period July 1, 1946, to June 30, 1947

(Ninety-eighth Fiscal Year)—Continued

	Detail	Total
Revenue for Fish and Game Preservation Fund:		
1947 series		
Angling		
Citizen	$898,806 00	
Non-resident	11,367 00	
Alien	6,015 00	
Duplicate	356 00	
Total angling		$916,544 00
Hunting		
Citizen	$20 00	
Fish packer and shellfish dealer—citizen	430 00	
Deer tags	6 00	
Fish tags	3,606 71	
Game tags	126 21	
Market fishermen	78,190 00	
Fish importer	65 00	
Fish party boat permits	529 00	
Fish breeder	400 00	
Game breeder	2,600 00	
Kelp license	40 00	
Game management area licenses	80 00	
Total 1947 series		$1,002,636 92
1946 series		
Angling		
Citizen	$773,065 00	
Non-resident	18,642 00	
Alien	6,520 00	
Duplicate	3,294 50	
Total angling		$801,521 50
Hunting		
Archery—citizen	$1,902 00	
Citizen	873,306 00	
Junior	41,317 00	
Archery—non-resident	145 00	
Non-resident	41,670 00	
Declarant alien	2,370 00	
Alien	3,225 00	
Duplicate	2,305 00	
Total hunting		$966,240 00
Commercial hunting club		$725 00
Commercial hunting club operator		$245 00
Trapping		
Citizen	$1,961 00	
Alien	28 00	
		$1,989 00
Fish packer and shellfish dealer		
Citizen	$1,790 00	
Alien	20 00	
		$1,810 00

STATEMENT OF EXPENDITURES

For the Period July 1, 1946, to June 30, 1947, as of July 31, 1947

(Ninety-eighth Fiscal Year)

Function	Salaries and wages	Operating expenses	Equipment	Total
Administration—101				
Education and public information	$6,262 96	$12,072 86	$1,481 58	$19,817 40
Executive	10,650 00	7,703 98	1,159 03	19,513 01
Exhibits		504 61		504 61
Library	2,605 83	365 42	338 01	3,309 26
Office	25,539 89	115,509 95	296 83	141,346 67
Unallocated		383 75		383 75
Undistributed		—5 70		—5 70
Total Administration	$45,058 68	$136,534 87	$3,275 45	$184,869 00
Patrol and Law Enforcement—104				
Airplane		$1,487 03	$3,201 87	$4,688 90
Cannery inspection	$8,647 26	25 15		8,672 41
Executive	31,646 13	5,548 37	698 45	37,892 95
Land patrol	381,217 53	149,487 72	67,446 59	598,151 84
Marine patrol	108,950 37	54,129 51	21,220 96	184,300 84
Office	44,365 66	1,890 58	1,077 12	47,333 36
Unallocated		10,168 55		10,168 55
Total Patrol and Law Enforcement	$574,826 95	$222,736 91	$93,644 99	$891,208 85
Marine Fisheries—105				
Central Valley Water Project and salmon study	$33,047 66	$12,439 32	$9,860 98	$55,347 96
Executive	10,520 00	1,670 27	1,394 88	13,585 15
Fish cannery auditing		6,451 01		6,451 01
Laboratory	10,815 80	3,666 89	1,499 58	15,982 27
Library	2,041 86	67 15		2,109 01
Office	12,241 60	2,085 08		14,326 68
Scientific investigation	27,853 56	3,933 10	5 50	31,792 16
Statistics	35,796 45	10,356 36	54 44	46,207 25
Unallocated		511 19		511 19
Total Marine Fisheries	$132,316 93	$41,180 37	$12,815 38	$186,312 68
Fish Conservation—106				
Biological survey	$38,122 48	$11,047 28	$3,694 44	$52,864 20
Executive survey	16,740 00	2,127 49		18,867 49
Field supervision	27,590 00	2,344 18	802 40	30,736 58
Fish food unallocated		63,096 25		63,096 25
Fish planting		4,064 82	3,700 00	7,764 82
Fish rescue	8,652 91	2,585 44	3,009 92	14,248 27
Fish screens		3,010 15	9 82	3,019 97
Office	10,659 76	293 33	339 18	11,292 27
Operating expenses unallocated		1,358 27	298 07	1,656 34
Pollution inspection	3,320 00	105 14		3,425 14
Stream improvements	6,045 02	124 66		6,169 68
Statistical		59 29		59 29
Structural maintenance		8 32		8 32
Unallocated		11,741 23	119 89	11,861 12
Unallocated—auto, gas, oil		3,727 47		3,727 47
Alpine Hatchery		11 88		11 88
Basin Creek	7,516 70	2,641 53	22 30	10,180 53
Benbow Dam	2,015 00	361 12		2,376 12
Black Rock Springs		336 99		336 99
Blue Lake Egg Collecting Station		98 10		98 10
Brookdale	7,821 29	1,988 18	184 23	9,993 70
Burney Creek Hatchery	8,478 46	2,316 79	35 14	10,830 39
Cedar Creek		538 66		538 66
Central Valley	10,343 54	3,506 79	61 17	13,911 50
Copco Egg Collecting Station		85 00	256 25	341 25
Coy Flat	113 41	75 68		189 09
Crystal Lake		10 69	78 39	89 08
Fall Creek Hatchery		1,018 79	9 33	1,028 12
Feather River Hatchery		2,278 52	80 43	2,358 95
Fillmore Hatchery		16,482 85	8,096 56	24,579 41

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1946, to June 30, 1947, as of July 31, 1947—Continued

(Ninety-eighth Fiscal Year)

Function	Salaries and wages	Operating expenses	Equipment	Total
Fish Conservation—Continued				
Additional—				
Fall Creek Hatchery	$6,605 01			
Feather River Hatchery	6,232 84			
Fillmore Hatchery	26,806 05			$39,643 90
Heenan Lake Egg Collecting Station		$107 20		107 20
Hot Creek Hatchery	20,627 78	39,764 59	$2,161 51	62,553 88
Huntington Lake	325 00	6 15		331 15
June Lake Egg Collecting Station	193 55			193 55
Kaweah Hatchery	7,146 31	1,660 30	12 55	8,819 16
Kern Hatchery	3,585 28	2,148 06	1,166 07	6,899 41
Kings River Hatchery	7,832 75	3,183 00	76 77	11,092 52
Klamathon		434 43		434 43
Lake Almanor Hatchery	9,967 39	2,890 55	103 93	12,961 87
Little Walker Lake		113 45		113 45
Mad River Egg Collecting Station	1,029 74			1,029 74
Mojave River Hatchery	1,240 00	317 36	7,727 39	9,284 75
Moorehouse Springs Hatchery		244 50	32 98	277 48
Mt. Shasta Hatchery	58,556 97	14,252 06	565 62	73,374 65
Mt. Tallac Hatchery	5,026 46	2,845 50	2,796 10	10,668 06
Mt. Whitney	29,890 95	31,944 87	4,227 50	66,063 32
Owens Park Experimental Ponds		184 76		184 76
Prairie Creek Hatchery	7,828 53	2,217 63	202 59	10,248 75
Rush Creek Hatchery		24 20		24 20
San Lorenzo Hatchery		72 86		72 86
Sequoia Hatchery	5,794 51	1,425 98	18 99	7,239 48
Shasta River Hatchery	476 67	318 97		795 64
Snow Mountain Hatchery	1,013 54	325 72		1,339 26
Tahoe Hatchery	7,480 40	4,779 32	3,499 33	15,759 05
Tuolumne	837 74			837 74
Whittier Hatchery	10,607 10	2,809 15	99 43	13,515 68
Yosemite Hatchery	6,614 51	1,703 76		8,318 27
Yreka Warehouse			6 66	6 66
Yuba River Hatchery	4,246 13	219 93		4,466 06
Total Fish Conservation	$377,383 78	$251,439 19	$43,494 94	$672,317 91
Game Conservation—108				
Brawley Game Farm	$940 00	$526 60	$1,092 78	$2,559 38
Castaic Farm	2,640 00	755 52		3,395 52
Chino Farm		338 91	1,229 15	1,568 06
Elk Refuge	2,980 00	1,071 64		4,051 64
Executive	15,474 61	3,142 89	941 24	19,558 74
Fresno Game Farm	9,101 50	4,283 87	70 54	13,455 91
Game Bird District—Los Serranos	400 00			400 00
Game Management	45,839 23	24,256 05	652 51	70,747 79
Grey Lodge Refuge	8,263 32	1,178 85		9,442 17
Honey Lake Refuge	8,821 41	4,183 42	409 07	13,413 90
Imperial Refuge	4,910 00	1,618 66		6,528 66
Imperial Valley Public Shoot Grounds		2,204 08		2,204 08
Los Banos Refuge	5,640 00	2,045 41	76 96	7,762 37
Los Serranos Game Farm	18,914 87	11,277 68	25 33	30,217 88
Marysville Game Farm			1,119 06	1,119 06
Office	9,217 40	628 65	306 21	10,152 26
Porterville Game Farm	1,619 35	737 86	1,122 16	3,479 37
Predatory Animal Lion Hunting	12,647 90	13,293 09	51 87	25,992 86
Predatory Animal Trapping	74,481 52	26,986 87	5,107 97	106,576 36
Predatory Birds		372 00		372 00
Redding Game Farm	5,128 57	1,965 47	1,052 04	8,146 08
Research	15,379 03	5,418 08	1,640 23	22,437 34
Sacramento Game Farm	5,050 98	1,665 08		6,716 06
Statistics		1,527 37		1,527 37
Suisun Refuge	4,525 07	1,032 07	24 81	5,581 95
Tehama Winter Deer Range			7 69	7 69
Unallocated—auto, gas, oil		4,114 13		4,114 13
Ukiah		277 63		277 63
Valley Center	1,910 00	809 62		2,719 62
Valley Center Farm		88 44		88 44
Visalia	310 00			310 00
Willows Game Farm	3,181 28	1,517 60		4,698 88
Winter feeding and salting of game		4 55		4 55
Yountville Boarding House	2,079 02	5,093 54		7,172 56
Yountville Game Farm	34,381 40	18,344 79	267 48	52,996 67
Total Game Conservation	$293,839 46	$140,760 42	$15,197 10	$449,796 98

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1946, to June 30, 1947, as of July 31, 1947—Continued

(Ninety-eighth Fiscal Year)

Function	Salaries and wages	Operating expenses	Equipment	Total
Licenses—111				
Executive	$9,180 00	$1,629 93		$10,809 93
License distribution	23,770 95	194,138 17	$1,046 90	218,956 02
Office	2,537 90	1,722 35	6 02	4,266 27
Unallocated—auto, gas, oil		169 98		169 98
Total Licenses	$35,488 85	$197,660 43	$1,052 92	$234,202 20
Construction of Fish Screens and Stream Improvements				
Reg—First quarter		$808 24		
BL—op—First quarter		279 33		
Reg—Second quarter		688 30		
BL—op—Second quarter		131 01		
Reg—Third quarter		1,034 96		
Reg—Fourth quarter		313 01		
Total Fish Screens		$3,254 85		$3,254 85
Total Fish and Game Supplement Ninety-eighth Fiscal Year				$2,621,962 47
Less Estimated Maintenance, Deductions				13,312 92
Net Total Fish and Game Supplement Ninety-eighth Fiscal Year				$2,608,649 55
Total Operating Expenditures Ninety-eighth Fiscal Year				$2,608,649 55
Additions and Betterments				
Land				
Appraisal of Welch Tract in Colusa County			$323 69	
Acquisition, establishment, maintenance of fish hatchery, Ch. 1439-45 Los Angeles County			7,214 95	
San Bernardino County			19,271 97	
Improvements—Ch. 644-45				
Alteration and modernization of hatchery buildings			7,902 98	
Alteration to Botanical Gardens Building—Game Conservation Research Laboratory			3,050 29	
Brooder houses and pens—Ch. 106-46				
Sacramento Game Farm			132 41	
Brooder houses and pens—Ch. 644-45				
Yountville Game Farm			4,166 82	
Brookdale Hatchery propane installation			1,128 00	
Central Valley Hatchery			682 78	
Coast counties quail project warehouse			1,363 17	
Construction of rearing ponds—all hatcheries			122 84	
Construction of salmon traps in Central Valleys and Trinity River watersheds			60 00	
Construction and equipment of workman shop and warehouse at Yreka			2,143 05	
Cattle guard fence Crystal Lake Hatchery			11,000 00	
Crystal Lake Hatchery			116,428 59	
Drilling of well—Kern Hatchery			461 79	
Engineering project			10,000 00	
Experimental electrical and mechanical fish screens			8,455 03	
Fish ladders and dams				
Clough Dam on Mill Creek			8,000 00	
Woodbridge Dam			65,400 00	
Game conservation				
Game farms—miscellaneous improvement			4,009 74	
Honey Lake Refuge			522 61	
Imperial County public shooting grounds			1,633 83	

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1946, to June 30, 1947, as of July 31, 1947—Continued

(Ninety-eighth Fiscal Year)

Function	Salaries and wages	Operating expenses	Equipment	Total
Additions and Betterments—Continued				
Improvement of game farms				
Brawley			$6,183 30	
Chico			448 11	
Marysville			4,306 72	
Porterville			5,737 28	
Improvement to Tule Lake and Madeline Reservoirs			4,114 72	
Kern Hatchery			172 56	
Mt. Tallac Hatchery			63 88	
Mt. Whitney Hatchery wire installations			850 00	
New construction—Tahoe Hatchery			3,705 50	
Redding Game Farm—cottage and garage			5,175 00	
Redding warehouse			358 05	
Remodel living quarters				
Fresno Game Farm			501 23	
Sacramento Game Farm			52 10	
Replace pipe lines—all hatcheries			794 17	
Tahoe Hatchery improvement			194 24	
Tehama winter range			5,385 00	
Terminal Island Laboratory			4,500 00	
Terminal Island parking area paving			760 00	
Tuna Fisheries Research Facilities			640 63	
Total Additions and Betterments				$317,417 03
Special Item—cooperation with Federal Government—Pittman-Robertson Act			OE-Equip.	
All projects	$36,688 68		$107,632 85	$144,321 53
Less indirect abatement from Federal Government—Pro rata share Pittman-Robertson Act				30,937 46
Net Total Pittman-Robertson Act				$113,384 07
Contributions to State Employees Retirement Fund				108,358 97
Grand Total Fish and Game Preservation Fund Ninety-eighth Fiscal Year				$3,147,809 62

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)

Function	Salaries and wages	Operating expenses	Equipment	Total
Divisional Administration—1A				
Executive	$11,387 35			$11,387 35
Library	6,635 27			6,635 27
Office	39,490 87	$7,643 00	$1,932 00	49,065 87
Accident and death claims		16,356 00		16,356 00
Automobile mileage		667 00		667 00
Automobile operation		1,440 00	50 00	1,490 00
Freight, cartage and express		1,682 00		1,682 00
Legal advertising		1,889 00		1,889 00
Light, heat and power		2,187 00		2,187 00
Postage		13,973 00		13,973 00
Printing		5,601 00		5,601 00
Pro rata Attorney General's services		6,000 00		6,000 00
Pro rata departmental administration		58,623 00		58,623 00
Pro rata Personnel Board's service		21,780 00		21,780 00
Pro rata general fiscal administration		21,275 00		21,275 00
Rent of premises		14,449 00		14,449 00
Repair of equipment		63 00		63 00
Telephone and telegraph		13,832 00		13,832 00
Travel		9,408 00		9,408 00
Repair of premises		601 00		601 00
Operating equipment			3 00	3 00
Photography			5 00	5 00
Total Administration	$57,513 49	$197,469 00	$1,990 00	$256,972 49
Conservation Education and Public Information				
Regular help	$9,775 00			$9,775 00
Exhibits		$1,489 00		1,489 00
Operating supplies and expenses		2,079 00		2,079 00
Photography		25,263 00	$1,395 00	26,658 00
Printing		25,297 00		25,297 00
Rent of equipment		25 00		25 00
Repair of equipment		31 00		31 00
Telephone and telegraph		98 00		98 00
Travel		2,051 00		2,051 00
Office			150 00	150 00
Operating equipment			372 00	372 00
Automobile operation		1,440 00		1,440 00
Books and publications			710 00	710 00
Freight, cartage and express		3 00		3 00
Total Conservation Education and Public Information	$9,775 00	$57,776 00	$2,627 00	$70,178 00
Patrol and Law Enforcement—1B				
Air patrol	$2,873 40			$2,873 40
Headquarters	21,008 88			21,008 88
Cannery inspector	13,128 92			13,128 92
Land patrol	478,775 36			478,775 36
Marine patrol, headquarters	99,753 58			99,753 58
Marine patrol	39,150 30			39,150 30
Airplane		$205 00	$146 00	351 00
Auto		118,732 00	84,875 00	203,607 00
Auto mileage		24 00		24 00
Boats operation		22,049 00	25,480 00	47,529 00
Freight, cartage and express		167 00		167 00
Light, heat and power		329 00		329 00
Office		53 00	617 00	670 00
Operating		18,283 00	5,717 00	24,000 00
Photography		60 00	200 00	260 00
Postage		160 00		160 00
Printing		2,321 00		2,321 00
Rent of equipment		2,103 00		2,103 00
Rent of premises		6,544 00		6,544 00
Telephone and telegraph		16,294 00		16,294 00
Travel		126,525 00		126,525 00
Undercover service		9,000 00		9,000 00
Radio			12,679 00	12,679 00
Total Patrol and Law Enforcement	$654,690 44	$322,819 00	$129,714 00	$1,107,253 44

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
Marine Fisheries—1C				
Headquarters	$33,591 87			$33,591 87
Central Valley's investigation	34,570 22			34,570 22
Library	3,060 00	$194 00		3,254 00
Marine fisheries investigation	59,999 33			59,999 33
Statistics	52,039 82			52,039 82
Vessel—N. B. Schofield	22,347 49			22,347 49
Auditing (professional services)		5,922 00		5,922 00
Auto operations		8,542 00	$6,770 00	15,312 00
Auto mileage		117 00		117 00
Cooperative research		612 00		612 00
Fish tagging		4,762 00		4,762 00
Freight, cartage and express		232 00		232 00
Laboratory supplies		1,266 00		1,266 00
Light, heat and power		1,847 00		1,847 00
Operating		14,424 00	17,106 00	31,530 00
Photography		549 00	236 00	785 00
Postage		64 00		64 00
Printing		13,251 00		13,251 00
Rent of equipment		8,487 00		8,487 00
Rent of premises		1,629 00		1,629 00
Repair of premises		2,282 00		2,282 00
Telephone and telegraph		671 00		671 00
Travel		14,750 00		14,750 00
Boat operations		16,016 00		16,016 00
Books and publications			126 00	126 00
Office			295 00	295 00
Household			63 00	63 00
Total Marine Fisheries	$205,608 73	$95,617 00	$24,596 00	$325,821 73
Fish Conservation—1D				
Biological survey	$64,116 12			$64,116 12
Headquarters	27,772 10			27,772 10
Fish screen and stream improvements	13,235 55			13,235 55
Hatcheries	315,025 64			315,025 64
Hatchery supervisor	29,524 18			29,524 18
Auto		$44,360 00	$18,932 00	63,292 00
Eyed eggs		7,825 00		7,825 00
Fish food		196,266 00		196,266 00
Freight, cartage, express		9,708 00		9,708 00
Laboratory supplies		16,001 00		16,001 00
Light, heat and power		26,446 00		26,446 00
Operating		15,102 00	17,789 00	32,891 00
Photography		265 00	221 00	486 00
Postage		1,222 00		1,222 00
Printing		1,040 00		1,040 00
Rent of equipment		6,455 00		6,455 00
Rent of premises		7,619 00		7,619 00
Repair of equipment		6,990 00		6,990 00
Repair of premises		10,008 00		10,008 00
Telephone and telegraph		3,733 00		3,733 00
Travel		23,361 00		23,361 00
Refrigeration		3,500 00		3,500 00
Boats			170 00	170 00
Household			2,944 00	2,944 00
Office			1,457 00	1,457 00
Total Fish Conservation	$449,673 59	$379,901 00	$41,513 00	$871,087 59
Game Conservation—1F				
Field supervision	$72,669 03			$72,669 03
Game farms	116,991 30			116,991 30
Game management	85,110 59			85,110 59
Headquarters	21,069 14			21,069 14
Predatory animal control	103,575 09			103,575 09
Auto mileage		$28 00		28 00
Auto		58,993 00	$76,984 00	135,977 00
Bounties		11,429 00		11,429 00
Freight, cartage, express		199 00		199 00
Game foods		30,005 00		30,005 00
Laboratory supplies		1,324 00		1,324 00
Light, heat and power		14,473 00		14,473 00
Office			1,458 00	1,458 00
Operating		18,166 00	48,041 00	66,207 00

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
Game Conservation—1F—Continued				
Photography		$440 00	$270 00	$710 00
Postage		207 00		207 00
Printing		1,884 00		1,884 00
Rent of building space		5,173 00		5,173 00
Rent of equipment		4,261 00		4,261 00
Repair and maintenance of structures		4,341 00		4,341 00
Repair of equipment		2,525 00		2,525 00
Boarding house (subsistence)		4,065 00		4,065 00
Telephone and telegraph		2,698 00		2,698 00
Travel		32,860 00		32,860 00
Less: Reimbursement for auto operation				
Pittman-Robertson		—10,699 00		—10,699 00
Household			877 00	877 00
Housing and subsistence			5,638 00	5,638 00
Total Game Conservation	$399,415 15	$182,372 00	$133,268 00	$715,055 15
Licenses—1G				
Regular help	$39,749 08			$39,749 08
Automobile		$1,056 43	$721 50	$1,777 93
Freight, cartage, express		2,910 59		2,910 59
License commissions—paid to agent		44,901 27		44,901 27
Office		590 25	988 26	1,578 51
Postage		3,438 40		3,438 40
Premium on bonds		7,878 56		7,878 56
Printing		22,079 11		22,079 11
Rent		1,222 25		1,222 25
Telephone and telegraph		160 18		160 18
Travel		1,701 24		1,701 24
Operating equipment			9 48	9 48
Total Licenses	$39,749 08	$85,938 28	$1,719 24	$127,406 60
Total allotment for support—Ninety-ninth Fiscal Year				$3,473,775 00
Less estimated maintenance deductions				15,806 30
Net total allotment for support—Ninety-ninth Fiscal Year				$3,457,968 70
Special Claim for Secretary of State Board of Control		$905 36		$905 36

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Detail	Total
Construction, Improvements, Repairs, and Equipment		
District offices:		
Redding and Alturas	$10,443 00	
Improvements to land and buildings	4,000 00	
Purchase of boat	118,309 00	
Purchase of airplane	30,000 00	
Terminal Island laboratory:		
Improvements to heating system	4,500 00	
Alterations and improvements—miscellaneous	1,455 00	
Research vessel	77,612 00	
Central Valley hatchery:		
Refrigeration facilities	1,714 00	
Sewer	576 00	
Fall Creek hatchery:		
Repairs to building	981 00	
Fillmore hatchery:		
Water facilities	4,570 00	
Refrigeration facilities	528 00	
Fresno:		
Experimental fish rearing tanks	987 00	
Hot Creek hatchery:		
Improvements to bachelor quarters	973 00	
Kaweah hatchery:		
Cabin	1,805 00	
Lake Almanor hatchery:		
Miscellaneous improvements	725 00	
Mt. Shasta hatchery:		
Repairs to residence	2,703 00	
Mt. Whitney hatchery:		
Repairs to bachelor quarters	1,523 00	
Pond improvements	3,070 00	
Bottled gas facilities	4,605 00	
Spawning and planting tanks	855 00	
Refrigeration facilities	2,692 00	
Kern River hatchery:		
Refrigeration facilities	3,449 00	
Madera hatchery:		
Electrification	408 00	
Repairs to building	381 00	
Repairs to living quarters	627 00	
Mojave River hatchery:		
Water pump	1,779 00	
Food preparation facilities	637 00	
Electrical standby unit	4,464 00	
Prairie Creek hatchery:		
Improvements to water system	1,482 00	
Mt. Tallac hatchery:		
Miscellaneous improvements	40 00	
Sequoia hatchery:		
Miscellaneous improvements	1,283 00	
Whittier hatchery:		
Food preparation facilities	1,087 00	
Improvements to utility building	300 00	
Tahoe hatchery:		
Miscellaneous improvements	631 00	
Yuba River hatchery:		
Electrification	241 00	
Tehama winter range:		
Fencing	817 00	
Imperial Valley waterfowl management area:		
Improvements to ponds	3,337 00	
Suisun refuge:		
Water supply	337 00	
Los Banos refuge:		
Water facilities	2,884 00	
Alterations to cottage	487 00	
Food habits and disease laboratory:		
Improvements	5,073 00	
Valley Center Game farm:		
Pump and well	4,500 00	

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Detail	Total
Construction, Improvements, Repairs, and Equipment—Continued		
Los Banos game farm:		
Pump, well, tank, and pipe	1,158 00	
Brooders, tool room, and equipment	2,574 00	
Garage and cabin	4,026 00	
Machinery	1,933 00	
Construction of rearing pens for pheasants:		
Rearing and holding pens	4,596 00	
Total Construction, Improvements, Repairs, and Equipment		$323,160 00
Special Item—Cooperation with Federal Government pro rata share Pittman-Robertson Act		
Restoration of valley quail in Sierra foothills	$13,298 25	
Evaluation of quail development and management practice in California	360 87	
Study of production, migration, and wintering areas of waterfowl in California	3,190 48	
Effects of brush removal on game ranges in California	2,768 16	
Study of deer population and management problems in California	10,145 50	
Food habits of mountain quail, ringnecked pheasant and coyote of California	7,887 43	
Life history and management of ringnecked pheasant in California	13,882 02	
Survey of waterfowl food plants of California	1,099 21	
Life history and management of mountain quail in California	6,617 29	
Doyle winter range	29,266 88	
Tehama winter deer range (Section No. 7)	1,262 65	
Tehama winter deer range (Section No. 6)	16,742 70	
Restoration of valley quail in all south coast ranges	21,200 87	
Beaver transplanting	5,985 30	
Total Pittman-Robertson Act		$133,707 61
Less reimbursement from Federal Government, Pittman-Robertson Act		—100,278 00
Net total Pittman-Robertson, Ninety-ninth Fiscal Year		$33,429 61
Contributions to Employees' Retirement Fund		260,000 00
Repair, restoration and maintenance of Jenner Jetty		37,500 00
Grand Total Fish and Game Preservation Fund—Ninety-ninth Fiscal Year		$4,112,058 31
General Fund		
Pacific Marine Fisheries Compact Expenses, Chapter 1447-47		$11,000 00

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
Wildlife Restoration Fund				
Support—Administration				
Senior Stenographer-Clerk	$1,242 00			$1,242 00
Office		$3 00	$581 00	584 00
Printing		155 00		155 00
Telephone and telegraph		6 00		6 00
Traveling		984 00		984 00
Automobile		34 00	1,671 00	1,705 00
Rent		10 00		10 00
Pro rata departmental administration		125 00		125 00
Pro rata Personnel Board's services		75 00		75 00
Total support Wildlife Restoration Fund	$1,242 00	$1,392 00	$2,252 00	$4,886 00

Function	Detail	Total
Wildlife Restoration Fund		
Capital Outlay—Construction, Improvements, Repairs, and Equipment		
Marine Fisheries		
Deer Creek fish screens	$3,575 00	
Preliminary work—architectural services	5,000 00	
Total Marine Fisheries		$8,575 00
Fish Conservation		
Crystal Lake hatchery:		
Improvements to ponds	$5,271 00	
Miscellaneous improvements	1,838 00	
Repairs to ranch house	682 00	
Refrigeration facilities	1,017 00	
Buildings and miscellaneous developments	115,000 00	
Total Fish Conservation		123,808 00
Game Conservation		
Brawley game farm:		
Rearing and holding pens	$5,146 00	
Pump, well, tank, and pipes	954 00	
Brooders, tool room and equipment	2,753 00	
Cabin and garage	2,384 00	
Incubator	2,562 00	
Chico game farm:		
Rearing and holding pens	4,931 00	
Brooders, tool room and equipment	3,767 00	
Cabin and garage	3,459 00	
Machinery	3,110 00	
Marysville game farm:		
Rearing and holding pens	4,711 00	
Pump, well, tanks, pipes, and hardware	3,726 00	
Brooder houses, feed room, tool room, and miscellaneous equipment	2,540 00	
Cabin and garage	1,787 00	
Porterville game farm:		
Rearing and holding pens	2,727 00	
Pump, well, tanks, pipes, and hardware	2,283 00	
Brooders, tool room, and equipment	1,992 00	
Coast counties quail habitat:		
Quonset type hut	2,242 00	
Water and feed facilities	613 00	
Southern California quail development:		
Salaries and wages	1,023 00	
Operating expenses	1,126 00	
Equipment	18,147 00	

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Detail	Total
Wildlife Restoration Fund—Continued		
Capital Outlay—Construction, Improvements, Repairs and Equipment—Continued		
Game Conservation—Continued		
Honey Lake waterfowl management area:		
Improvements to water control facilities and pond developments:		
Reservoir field	$3,078 00	
New road field	3,332 00	
Upper Lake fields	727 00	
Lower Lake fields	2,290 00	
Dakin ranch—Hartson reservoir and flood channel	2,060 00	
Dakin ranch—miscellaneous project	1,838 00	
Fleming ranch—improvements to reservoir dam and bed	1,080 00	
Imperial Valley public shooting grounds:		
Land leveling and lease	11,998 00	
Development of south pumice unit	1,250 00	
Development of north pumice unit	4,500 00	
Madeline plains waterfowl development:		
Garage and workshop	2,974 00	
Water control facilities	1,614 00	
Miscellaneous improvements to buildings and grounds	510 00	
Fencing	2,533 00	
Delivery ditch improvement	4,560 00	
Pump and well	1,000 00	
Total, Game Conservation		$117,327 00
Totals, Construction, Improvements, Repairs, and Equipment		249,710 00
Contribution to State Employees' Retirement System		117 00
Total, Wildlife Restoration Fund		$254,713 00

STATEMENT OF REVENUE

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)

	Detail	Total
Revenue for Fish and Game Preservation Fund:		
1948 Series:		
Angling citizen	$1,458,997 00	
Angling excess fee	210 10	
Nonresident one year	9,265 00	
Nonresident ten day	1,163 50	
Alien	17,550 00	
Duplicate	493 50	
Fish tags	6,348 80	
Game tags	165 36	
Fish importer	70 00	
Fish party boat permits	617 00	
Market fishermen	73,440 00	
Fish breeder	505 00	
Game breeder	2,565 00	
Kelp license	10 00	
Game management area licenses	350 00	
Game management area tags	3 60	
Hunting license	48 00	
Deer tags	12 00	
Deer meat agents locker permits	7,264 00	
Deer meat agents—wardens	304 00	
Total 1948 series		$1,579,381 86
1947 series:		
Angling citizen	$843,276 00	
Alien	6,650 00	
Nonresident	22,299 00	
Duplicate	4,613 50	
Hunting archery citizen	2,332 00	
Archery nonresident	75 00	
Hunting citizen	915,509 00	
Hunting junior	43,983 00	
Hunting nonresident	48,080 00	
Hunting declared alien	2,450 00	
Hunting alien	2,950 00	
Hunting duplicate	3,276 50	
Hunting commercial club citizen	675 00	
Hunting commercial club opr. citizen	225 00	
Trapping citizen	1,570 00	
Trapping alien	24 00	
Fish packer and shellfish dealer citizen	14,795 00	
Fish packer and shellfish dealer alien	580 00	
Archery deer tags	590 00	
Deer tags	299,604 00	
Fish tags	3,891 76	
Game tags	344 70	
Market fishermen	50,810 00	
Fish importer	40 00	
Fish party boat permits	155 00	
Fish breeder	70 00	
Game breeder	250 00	
Kelp license	50 00	
Game management area licenses	120 00	
Game management area tags	178 68	
Deer meat agents locker permits	4,000 00	
Deer meat agents wardens	397 00	
Total 1947 series		$2,273,864 14

STATEMENT OF REVENUE—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

	Detail	Total
Revenue for Fish and Game Preservation Fund:		
1946 series:		
Angling citizen	$4 00	
Angling alien	5 00	
Hunting citizen	254 00	
Hunting junior	22 00	
Hunting duplicate	11 00	
Trapping citizen	3 00	
Total 1946 series		$299 00
Other revenue:		
Lease of kelp beds	$1,565 00	
Fish packers tax	192,061 36	
Kelp tax	2,098 05	
Salmon packers tax	77,895 66	
Sardine tax	40,294 43	
Public shooting grounds	1,830 00	
Miscellaneous	27,534 99	
Court fines	123,739 25	
Interest on surplus money investment fund	15,430 41	
Total other revenue		$482,449 15
Grand total Fish and Game Preservation Fund		$4,335,994 15

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)

Function	Salaries and wages	Operating expenses	Equipment	Total
Administration:				
Conservation education and public information	$9,774 67			
Executive	11,387 35			
Library	6,635 27			$27,797 29
Office	39,490 87	$7,643 00	$1,931 52	49,065 39
Accident and death claims		16,356 00		
Auto mileage		667 00		17,023 00
Auto operation		1,440 00	48 58	1,488 58
Freight, cartage, express		1,682 00		
Legal advertising		1,889 00		
Light, heat, power		2,187 00		
Postage		13,973 00		
Printing		5,601 00		
Pro rata Attorney General's service		6,000 00		
Pro rata departmental administration		58,623 00		
Pro rata Personnel Board service		21,780 00		
Pro rata general fiscal administration		21,275 00		
Rent of premises		14,449 00		
Repair of equipment		63 00		
Telephone and telegraph		13,832 00		
Travel		9,408 00		
Repair of premises		601 00		171,363 00
Books and publications			709 90	
Operating equipment			371 48	
Photography			4 54	1,085 92
Total Administration	$67,288 16	$197,469 00	$3,066 02	$267,823 18
Patrol and Law Enforcement:				
Air patrol	$2,873 40			
Headquarters	21,008 88			
Cannery inspector	13,128 92			
Land patrol	476,775 36			
Marine patrol, headquarters	99,753 58			
Marine patrol	39,150 30			$654,690 44
Airplane		$205 00	$146 00	351 00
Auto		118,732 00	84,875 00	203,607 00
Auto mileage		24 00		24 00
Boats operation		22,049 00	25,480 00	47,529 00
Freight, cartage, express		167 00		
Light, heat, power		329 00		496 00
Office		53 00	617 00	670 00
Operating		18,283 00	5,717 00	24,000 00
Photography		60 00	200 00	260 00
Postage		160 00		
Printing		2,321 00		
Rent of equipment		2,103 00		
Rent of premises		6,544 00		
Telephone and telegraph		16,294 00		
Travel		126,525 00		
Undercover service		9,000 00		162,947 00
Radio			12,679 00	12,679 00
Total Patrol and Law Enforcement	$654,690 44	$322,849 00	$129,714 00	$1,107,253 44
Fish Conservation:				
Biological survey	$64,116 12			
Headquarters	27,772 10			
Fish screen and stream improvement	13,235 55			
Hatcheries	315,025 64			
Hatchery supervisor	29,524 18			$149,673 59
Auto		$44,360 00	$18,932 00	63,292 00
Eyed eggs		7,825 00		
Fish food		196,266 00		
Freight, cartage, express		9,708 00		
Laboratory supplies		16,001 00		
Light, heat, power		26,446 00		256,246 00
Operating		15,102 00	17,789 00	32,891 00
Photography		265 00	221 00	486 00
Postage		1,222 00		
Printing		1,040 00		
Rent of equipment		6,455 00		
Rent of premises		7,619 00		
Repair of equipment		6,990 00		

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
Fish Conservation—Continued				
Repair of premises		$10,008 00		
Telephone and telegraph		3,733 00		
Travel		23,361 00		
Refrigeration		3,500 00		$63,928 00
Boats			$170 00	
Household			2,944 00	
Office			1,457 00	4,571 00
Total Fish Conservation	$449,673 59	$379,901 00	$41,513 00	$871,087 59
Marine Fisheries:				
Headquarters	$33,591 87			
Central Valleys investigation	34,570 22			$68,162 09
Library	3,060 00	$194 00		3,254 00
Marine fisheries investigation	59,999 33			
Statistics	52,039 82			
Vessel—N. B. Scofield	22,347 49			134,386 61
Auditing—professional services		5,922 00		5,922 00
Auto operations		8,542 00	$6,770 00	15,312 00
Auto mileage		117 00		
Cooperative research		612 00		
Fish tagging		4,762 00		
Freight, cartage, express		232 00		
Laboratory supplies		1,266 00		
Light, heat, power		1,847 00		8,836 00
Operating		14,424 00	17,106 00	31,530 00
Photography		549 00	236 00	785 00
Postage		64 00		
Printing		13,251 00		
Rent of equipment		8,487 00		
Rent of premises		1,629 00		
Repair of premises		2,282 00		
Telephone and telegraph		671 00		
Travel		14,750 00		
Boat operations		16,016 00		57,150 00
Books and publications			126 00	
Office			295 00	
Household			63 00	484 00
Total Marine Fisheries	$205,608 73	$95,617 00	$24,596 00	$325,821 73
Game Conservation:				
Field supervision	$72,669 03			
Game farms	116,991 30			
Game management	85,110 59			
Headquarters	21,069 14			
Predatory animal control	103,575 09			$399,415 15
Auto mileage		$28 00		28 00
Auto		58,993 00	$76,984 00	135,977 00
Bounties		11,429 00		
Freight, cartage, express		199 00		
Game foods		30,005 00		
Laboratory supplies		1,324 00		
Light, heat, power		14,473 00		57,430 00
Office			1,458 00	1,458 00
Operating		18,166 00	48,041 00	66,207 00
Photography		440 00	270 00	710 00
Postage		207 00		
Printing		1,884 00		
Rent of building space		5,173 00		
Rent of equipment		4,261 00		
Repair and maintenance of structures		4,341 00		
Repair of equipment		2,525 00		
Boarding house—subsistence		4,065 00		
Telephone and telegraph		2,698 00		
Travel		32,860 00		58,014 00
Less reimbursement for auto operation Pittman-Robertson		—10,699 00		—10,699 00
Household			877 00	
Housing ans subsistence			5,638 00	6,515 00
Total Game Conservation	$399,415 15	$182,372 00	$133,268 00	$715,055 15

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
Licenses:				
Licenses	$39,749 08			$39,749 08
Automobile		$1,056 43	$721 50	1,777 93
Freight, cartage, express		2,910 59		
License commission paid to agent		44,901 27		47,811 86
Office		590 25	988 26	1,578 51
Postage		3,438 40		
Premium on bonds		7,878 56		
Printing		22,079 11		
Rent		1,222 25		
Telephone and telegraph		160 18		
Travel		1,701 24		36,479 74
Operating equipment			9 48	9 48
Total Licenses	$39,749 08	$85,938 28	$1,719 24	$127,406 60
Total support for Ninety-ninth Fiscal Year				3,414,447 69
Less estimate maintenance deduction				—15,806 30
Net total support Ninety-ninth Fiscal Year				$3,398,641 39
Special claim for Secretary of State, Board of Control		$905 36		$905 36
Additions and Betterments:				
Improvements—Administration:			Detail	
Office buildings—Redding, Alturas			$10,443 00	
Installation of plumbing, air conditioning, etc.			4,000 00	
Patrol and Law Enforcement:				
Purchase of boat			118,309 00	
Airplane			30,000 00	
Marine fisheries:				
Modernization of heating system			4,500 00	
Alterations of building			1,455 00	
Research vessel			77,612 00	
Fish conservation:				
Repairs to Fall Creek Hatchery building			981 00	
Refrigeration facilities, Central Valley			1,714 00	
Central Valley sewer			576 00	
Refrigeration facilities, Fillmore Hatchery			528 00	
Fillmore Hatchery water facility			4,570 00	
Fresno Hatchery experimental fish rearing tanks			987 00	
Hot Creek Hatchery — Remodeling bachelor quarters			973 00	
Kaweah Hatchery—Cabin			1,805 00	
Kern River Hatchery—Refrigeration facilities, etc.			3,449 00	
Lake Almanor Hatchery—Miscellaneous improvements			725 00	
Madera Hatchery—Electrification			408 00	
Mojave River Hatchery—Water pump			1,779 00	
Mojave River Hatchery — Food preparation facilities			637 00	
Mojave River Hatchery—Electric standby unit			4,464 00	
Mt. Shasta Hatchery—Repairs to residence			2,703 00	
Madera Hatchery—Repairs to hatchery buildings			381 00	
Madera Hatchery—Repairs and alterations to living quarters			627 00	
Mt. Tallac Hatchery—Utility building			40 00	
Improved water system—Prairie Creek Hatchery			1,482 00	
Mt. Whitney Hatchery—Bottled gas facility			4,605 00	
Mt. Whitney Hatchery—Pond improvement			3,070 00	
Mt. Whitney Hatchery—Refrigeration facilities, etc.			2,692 00	
Mt. Whitney Hatchery—Repairs to bachelor quarters			1,523 00	
Mt. Whitney Hatchery—Spawning and planting tanks			855 00	
Sequoia Hatchery—Refrigeration facility			1,283 00	
Tahoe Hatchery—Liquid gas installation			634 00	
Whittier Hatchery—Food preparation facility			1,087 00	
Whittier Hatchery—Improvement utility building			300 00	
Yuba River Hatchery—Electrification			241 00	

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
Additions and Betterments—Continued				
Game conservation:				
Valley Center Game Farm—Pump and well			$4,500 00	
Los Banos Refuge—Water facility			2,884 00	
Los Banos Refuge—Alteration to cottage			487 00	
Suisun Refuge—Water supply			337 00	
Tehama winter range fence			817 00	
Food habits and disease laboratory			5,073 00	
Imperial Valley Public Shooting Grounds—Pond and water facility			3,337 00	
Los Banos Game Farm—Pump, well tank and pipe			1,158 00	
Brooder, toolroom and equipment			2,574 00	
Garage and cabin			4,026 00	
Machinery			1,933 00	
Construction of rearing pens for pheasants			4,596 00	
Total improvements				$323,160 00
Total additions and betterments				$323,160 00
Cooperation with Federal Government Pittman-Robertson Act:				
26D-3 restoration of valley quail in Sierra foothills			$13,298 25	
Evaluation of quail development and management practice in California			360 87	
30R-1 study of production, migration and wintering areas of waterfowl in California			3,190 48	
31R-1 effects of brush removal on game ranges in California			2,768 16	
28R-1 study of deer population and management problems in California			10,145 50	
25R-2 food habits of mountain quail, ringnecked pheasant and coyote of California			7,887 43	
22R-3 life history and management of ringnecked pheasant in California			13,882 02	
20R-3 survey of waterfowl foodplants			1,099 21	
19R-3 life history and management of mountain quail in California			6,617 29	
21L-1 Doyle winter range			29,266 88	
10L-7 Tehama winter deer range			1,262 65	
10L-6 Tehama winter deer range			16,742 70	
26D-2 restoration of valley quail in all south coast ranges			21,200 87	
18D-1 Beaver transplanting state-wide			3,812 74	
18D-2 Beaver transplanting			2,172 56	
Total Pittman-Robertson Act				133,707 61
Less reimbursement from Federal Government for Pittman-Robertson				—100,278 00
Net total Pittman-Robertson Ninty-ninth Fiscal Year				33,429 61
Contribution to employees retirement fund				260,000 00
Grand total Fish and Game Preservation Fund Ninty-ninth Fiscal Year				$4,016,136 36

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
General fund:				
Pacific marine fisheries compact expenses Chapter 1447/47			$11,000 00	$11,000 00
Wildlife restoration fund:				
Support:				
Senior stenographer-clerk	$1,242 00			
Office		$3 00	$581 00	
Printing		155 00		
Telegraph and telephone		6 00		
Traveling		984 00		
Automobile		34 00	1,671 00	
Rent		10 00		
Pro rata departmental administration		125 00		
Pro rata personnel board service		75 00		
Total support wildlife restoration fund	$1,242 00	$1,392 00	$2,252 00	$4,886 00
Capital Outlay—Construction, improvements, repairs and equipment:				
Marine fisheries:				
Deer Creek fish screens			$3,575 00	
Preliminary work architectural service			5,000 00	
Total marine fisheries			$8,575 00	$8,575 00
Wildlife Restoration Fund:				
Capital outlay—Contruction, improvement, repairs and equipment:				
Fish conservation:				
Crystal Lake Hatchery:				
Improvement to ponds			$5,271 00	
Miscellaneous improvement			1,838 00	
Repair to ranch house			682 00	
Refrigeration facility			1,017 00	
Building and miscellaneous development			115,000 00	
Total fish conservation			$123,808 00	
Game conservation:				
Brawley Game Farm:				
Rearing and holding pens			$5,146 00	
Pump, well, tank and pipe			954 00	
Brooders, toolroom and equipment			2,753 00	
Cabin and garage			2,384 00	
Incubator			2,562 00	
Chico Game Farm:				
Rearing and holding pens			4,931 00	
Brooders, toolroom and equipment			3,767 00	
Cabin and garage			3,459 00	
Machinery			3,110 00	
Marysville Game Farm:				
Rearing and holding pens			4,711 00	
Pump, well, tank pipe and hardware			3,726 00	
Brooders, feed room, toolroom and miscellaneous equipment			2,540 00	
Cabin and garage			1,787 00	
Porterville Game Farm:				
Rearing and holding pens			2,727 00	
Pump, well, tank, pipe and hardware			2,283 00	
Brooders, toolroom and equipment			1,992 00	
Coast Counties Quail Habitat:				
Quonset type hut			2,242 00	
Water and feed facilities			613 00	
Southern California Quail Development:				
Salaries and wages			1,023 00	
Operating expenses			1,126 00	
Equipment			13,147 00	

STATEMENT OF EXPENDITURES (COMPLETE) BY OBJECT—Continued

For the Period July 1, 1947, to June 30, 1948

(Ninety-ninth Fiscal Year)—Continued

Function	Salaries and wages	Operating expenses	Equipment	Total
Wildlife Restoration Fund—Continued				
Capital Outlay—Construction, Improvements, Repairs, and Equipment—Continued				
Game Conservation—Continued				
Honey Lake Waterfowl Management Area:				
Fleming Ranch—Improvements to reservoir, dam and bed			$1,080 00	
Improvements to water control:				
Facilities and pond development:				
Reservoir field			3,078 00	
New road fields			3,332 00	
Upper lake fields			727 00	
Lower lake fields			2,290 00	
Dakin Ranch—Harston reservoir flood channel			2,060 00	
Dakin Ranch—Miscellaneous projects			1,838 00	
Imperial Valley Public Shooting Grounds:				
Land leveling and lease			11,998 00	
Development of south pumice unit			1,250 00	
Development of north pumice unit			4,500 00	
Madeline Plains Waterfowl Development:				
Garage and workshop			2,974 00	
Water control facilities			1,614 00	
Miscellaneous improvements to buildings and grounds			510 00	
Fencing			2,533 00	
Delivery ditch improvement			4,560 00	
Pump and well			1,000 00	
Total Game Conservation			$117,327 00	
Total construction, improvements, repairs and equipment			$249,710 00	
Contributions to state employees retirement system			$117 00	$117 00
Total Wildlife Restoration Fund				$254,713 00

ARRESTS, FINES AND SEIZURES

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TOTAL ARRESTS FOR PERIOD OF 46 YEARS

1902-1904	550	1926-1928	4,390
1904-1906	774	1928-1930	5,388
1906-1908	1,192	1930-1932	5,237
1908-1910	1,771	1932-1934	3,795
1910-1912	2,063	1934-1936	4,535
1912-1914	1,993	1936-1938	6,382
1914-1916	2,087	1938-1940	7,444
1916-1918	1,797	1940-1942	7,262
1918-1920	1,891	1942-1944	4,298
1920-1922	2,258	1944-1946	5,902
1922-1924	2,715	1946-1948	11,331
1924-1926	3,207		

ARRESTS AND CONVICTIONS RECAPITULATION

	Number of arrests	Fines imposed	Jail sentences (days)
Fish cases 1946-1947	2,977	$100,817 50	1,828
Game cases 1946-1947	2,374	$129,132 00	1,700½
Totals 1946-1947	5,351	$229,949 50	3,528½
Fish cases 1947-1948	3,492	$97,704 00	169½
Game cases 1947-1948	2,488	$148,713 50	2,509½
Totals 1947-1948	6,980	$246,417 50	2,679
Recapitulation:			
1946-1947	5,351	$229,949 50	3,528½
1947-1948	6,980	$246,417 50	2,679
Totals	11,331	$476,367 00	6,207½

SEIZURES OF FISH AND GAME

FISH CASES

	July 1, 1946 to June 30, 1947	July 1, 1947 to June 30, 1948	Total
Fish			
Abalones	5,344	3,366	8,710
Abalones, pounds	1,237½	3,659	4,896½
Bass	343	926	1,269
Bass, pounds	1,251	4,260	5,511
Barracuda	208	71	279
Barracuda, pounds	4,062	2,112	6,174
Catfish	288	410	698
Catfish, pounds	250	598	848
Clams	3,641	18,303	21,944
Cockles	10,573	22,559	33,132
Carp	114	7	121
Carp, pounds	----	500	500
Crabs	908	216	1,124
Crabs, pounds	----	1,200	1,200
Crappie	57	40	97
Bonito, pounds	----	115	115
Halibut	1	5	6
Lobsters	1,995	411	2,406
Lobsters, pounds	7,522½	8,162	15,684½
Mackerel and sardines, pounds	40	1,027,795	1,027,830
Octopus	9	----	9
Rock bass	47	----	47
Salmon	79	73	152
Salmon, pounds	1,362	386	1,748
Seallops	----	144	144
Sturgeon	1	1	2
Sturgeon, pounds	10	----	10
Sunfish	135	1,852	1,987
Sunfish, pounds	----	45	45
Suckers	----	68	68
Trout	1,207	1,459	2,666
Trout, pounds	4,856	196	5,052
Yellowfin croaker	----	20	20
Yellowfin croaker, pounds	----	300	300
Skipjack	----	7,680	7,680

GAME CASES

	July 1, 1946 to June 30, 1947	July 1, 1947 to June 30, 1948	Total
Game			
Bear	1	1	2
Bear meat, pounds	----	135	135
Antelope	----	1	1
Coots	35	33	68
Deer	109	143	252
Deer meat, pounds	5,931	2,940	8,871
Doves	411	841	1,252
Ducks	623	1,340	1,963
Gallinule	----	1	1
Grouse	----	1	1
Geese	145	149	294
Frogs	379	139	518
Hamsters	13	----	13
Pheasants	307	251	558
Quail	141	68	209
Rabbits	180	145	325
Sagehens	7	----	7
Seagulls	4	3	7
Shorebirds	29	76	105
Squirrels	9	22	31
Swan	1	12	13
Non-game	36	27	63
Antelope meat, pounds	35	----	35
Pine marten	----	7	7
Pigeons	1	35	36

FISH CASES

Offense	July 1, 1946, to June 30, 1947			July 1, 1947, to June 30, 1948		
	Arrests	Fines	Jail	Arrests	Fines	Jail
Abalones: Undersize; over limit; out of shell; no license; failure to show; taking to sell commercially	576	$18,495 00	35	483	$14,174 00	40¼
Angling: Failure to show license; closed stream; set line; spearing; gaffing 300′ of stream; no license; using another's license; shooting fish; nonresident using resident license; night fishing; use of explosives; using traps; back dating license; game fish for bait	606	12,047 00	755	1,240	21,821 50	27½
Bass: Night fishing; selling and buying striped bass; under size; overlimit; possession closed season; undersize for bait; early fishing; late fishing; seining	478	13,729 50	4	354	10,262 00	6
Barracuda: No license; overlimit; on boat with purse seine net; sale of undersize	1	5 00		12	400 00	
Catfish: Closed season; undersize; overlimit; selling and purchasing undersize; set lines	12	1,572 50		28	520 00	
Chumming: Inland waters; for trout with cluster salmon eggs	7	275 00		16	730 00	
Clams: Undersize; overlimit; closed season; out of shell; early and late clamming	341	10,778 00	529	524	13,104 00	79½
Crappie: Overlimit; closed season; seining	27	402 00		11	225 00	
Crabs: Undersize; overlimit; failure to issue market receipts; taking on Sunday	39	3,830 00		19	925 00	
Cockles: Overlimit; undersize; failure to show	22	510 00		78	1,990 00	
Bluegill: Closed season; overlimit; netting	131	3,608 00		139	3,568 50	
Croakers: Illegal sale; round haul net	4	200 00		3	150 00	
Perch: No license; closed season; selling without tags	2	60 00		2	35 00	
Lobsters: Overlimit; undersize; closed season; traps closed district; selling oversize; possession unpunched; no boat registration	65	3,570 00		54	2,787 00	
Salmon: Undersize; closed season; spawning bed; snagging; shooting; gaffing; drift gill net; night fishing	26	7,441 00		115	2,473 00	16
Sturgeon: Possession	1	75 00				
Scallops: Taking, no license				1	20 00	
Trout: Closed season; set line; closed stream; overlimit; untagged for sale; spearing at night; chumming with salmon eggs; use of explosives; within 300′ mouth of stream	390	11,344 50	505	153	5,328 00	
Seals: Shooting	1	25 00		3	75 00	
Commercial: Illegal diving; no license; trawl net closed area; failure to keep records; operating lampara net closed area; illegal gill net; failure to keep log; round haul net District 19A; failure to pay privilege tax; operating beach seine District 4; fyke nets, closed district; fish wastage; no packers' license; failure to register with Fish and Game; oversize mesh; failure to show license on demand	203 2	8,825 00 300 00		174	10,451 00	
Pollution: Oil; sawdust; edgings; tannic acid; sewage; fish refuse	42	3,700 00		58	8,475 00	
Mackerel and Sardines: Using more than 32½% in reduction; more than 25% small size; delivering and receiving undersize	1	25 00		25	190 00	
Totals	2,977	$100,817 50	1,828 days	3,492	$97,704 00	169½ days

GAME CASES

Offense	July 1, 1946, to June 30, 1947			July 1, 1947, to June 30, 1948		
	Arrests	Fines	Jail	Arrests	Fines	Jail
Antelope: Closed season	1			1		
Bear: Closed season				3	50 00	
Beaver	2	100 00				
Coots: Closed season; shooting from auto; rifle; no license	21	490 00		21	385 00	
Deer: Closed season; spike buck; spotlighting; failure to tag properly; doe; taking in refuge; altering tag; illegal possession; second deer district 1; failure to keep hides; transferring tag; .22 rifle; killing fawn; taking forked horn; no tags; possessing tags issued to another; purchase of fawn; selling fawn; overlimit	504	49,954 50	848	444	53,135 50	993
Deer Meat: Closed season; illegal possession; unmarked; no entry permit; sale; yearling; spike buck	101	8,951 00	624½	127	15,279 00	1,137
Doves: Closed season; overlimit; failure to show license; unplugged gun; taking from motor vehicle; early and late shooting; .22 rifle	162	4,855 00		223	7,079 00	8
Ducks: Closed season; unplugged gun; overlimit; offering for sale; in refuge; late shooting; shooting from motor boat; no license; failure to show	212	9,842 00		448	20,191 50	180
Frogs: Under size; overlimit; closed season	6	170 00		19	520 00	
Elk: Illegal possession	1	200 00				
Geese: Overlimit; late shooting; keeping in captivity	35	1,370 00		67	2,032 00	
Grouse: Possession	1	25 00		2	75 00	
Grebe: Possession	2	35 00		2	50 00	
Gallinule: Closed season				1	75 00	
Pheasants: Closed season; hen; early shooting; from vehicle; overlimit; .22 rifle; selling untagged	351	26,987 00	193	206	11,470 00	
Quail: Closed season; overlimit; trapping; unplugged gun	66	2,784 50		52	1,431 00	
Rabbit: Closed season; no license; taking at night; operating snares	140	3,785 50		33	765 00	
Pigeons: Closed season; overlimit	2	50 00		23	795 00	30
Nongame: No permit; trapping; possession	46	1,576 00	32	31	827 50	20
Swan: Possession; killing	5	97 50		18	680 00	
Shorebirds	21	842 50		32	825 00	
Hunting: No license; night hunting; in refuge; closed season; shooting from motor boat; early and late shooting; transferance of license; resident license used by nonresident; unplugged gun; shooting from auto; posted land	684	16,839 50	3	637	30,133 00	141½
Trespass: In refuge	1	25 00		29	615 00	
Trapping: No license; harboring game birds; removing animals from state trapper's trap	8	87 00		3	120 00	
Fur Bearing Mammals: Bear: closed season; Marten: closed season	2	65 00		4	135 00	
Deer Tags: Possession other than own; failure to validate; failure to carry; "A" tag in one-deer district; altering				62	2,045 00	
Totals	2,374	$129,132 00	1,700½ days	2,488	$148,713 50	2,509½ days

MARINE FISHERIES STATISTICS

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TABLE 1

California Fisheries Production

	1946	1947	Total
Total landings, pounds	919,334,000	795,092,000	1,714,426,000
Cases of fish canned	9,085,235	10,243,991	19,329,226
Tons of fish meal produced	52,895	37,065	89,960
Gallons of fish oil produced	4,902,625	2,633,604	7,536,229
Gallons of liver oil produced	169,586	221,557	391,143
Value of canned and processed fishery products	$102,420,392	$132,721,357	$235,141,749

TABLE 2

Pounds and Value of Commercial Fish Landings in California

Species	1946		1947	
	Pounds	Value	Pounds	Value
Yellowfin tuna	127,247,000	$14,614,000	150,459,000	$23,445,000
Skipjack	41,088,000	4,283,000	52,462,000	7,586,000
Sardine	510,759,000	6,853,000	255,514,000	5,802,000
Jack mackerel	15,093,000	327,000	129,048,000	3,323,000
Bluefin tuna	22,032,000	2,246,000	20,838,000	3,321,000
Albacore	18,068,000	3,587,000	13,427,000	3,140,000
Salmon	13,658,000	2,375,000	11,445,000	2,265,000
Bonito	5,626,000	536,000	13,697,000	1,606,000
Pacific mackerel	53,875,000	1,431,000	46,478,000	1,390,000
Shark	1,605,000	1,615,000	2,638,000	1,325,000
Crab	9,641,000	1,319,000	10,733,000	1,305,000
Yellowtail	4,562,000	374,000	9,953,000	1,124,000
Sole	10,569,000	506,000	12,334,000	628,000
Spiny lobster	1,918,000	611,000	1,763,000	513,000
Rockfish	11,173,000	552,000	8,499,000	416,000
Squid	38,025,000	1,215,000	14,543,000	391,000
Barracuda	3,107,000	399,000	2,666,000	351,000
California halibut	2,500,000	433,000	1,839,000	339,000
Anchovy	1,922,000	43,000	18,941,000	335,000
Broadbill swordfish	859,000	269,000	1,010,000	322,000
Abalone	2,096,000	254,000	2,670,000	307,000
White sea bass	616,000	117,000	1,083,000	231,000
Ling cod	1,156,000	102,000	1,941,000	163,000
Catfish	410,000	108,000	299,000	85,000
Sablefish	2,659,000	256,000	902,000	77,000
Northern halibut	358,000	71,000	231,000	54,000
Shrimp	437,000	22,000	843,000	51,000
All other	18,272,000	828,000	8,836,000	552,000
Totals	919,334,000	$45,346,000	795,092,000	$60,447,000

TABLE 3

Nationality of Commercial Fishermen

Nativity	1946-47	1947-48
United States	8,513	9,058
Italy	1,339	1,362
Jugoslavia	736	782
Norway	454	454
Portugal	370	378
Great Britain	198	172
Sweden	92	96
Spain	60	56
Denmark	59	58
Finland	51	63
Philippine Islands	50	38
Germany	49	51
Mexico	48	57
Greece	47	53
Russia	38	38
Austria	21	21
All others	187	157
Totals	12,312	12,894

TABLE 4

Residence of Licensed Commercial Fishermen

Region of residence	1946-47	1947-48
Eureka	845	856
Sacramento	671	672
San Francisco	1,384	1,312
Monterey	1,294	1,372
Santa Barbara	569	617
Los Angeles	4,741	4,970
San Diego	2,127	2,405
Alaska, Oregon, Washington	666	676
Mexico	15	14
Totals	12,312	12,894

TABLE 5

Tuna Catch in Pounds

Species	1946	1947
Yellowfin	127,247,000	150,459,000
Skipjack	41,088,000	52,462,000
Bluefin	22,032,000	20,838,000
Bonito	5,626,000	13,697,000
Albacore	18,068,000	13,427,000
Totals	214,061,000	250,883,000

TABLE 6

Catches of Bottom Fish, in Pounds

Species	1946	1947
Flatfish:		
Sole	10,569,000	12,334,000
Sand dab	679,000	701,000
Starry flounder	509,000	527,000
Turbot	50,000	102,000
Rockfish (rock cod)	11,173,000	8,499,000
Sablefish (black cod)	2,659,000	902,000
Ling cod	1,156,000	1,941,000
Totals	26,795,000	25,006,000

TABLE 1. FISH PLANTED—1946

Hatchery Reared Fish Planted in Each County

County	Trout					Salmon, King	Total number of fish
	Rainbow	Steelhead	Cutthroat	Eastern brook	Brown		
Alpine	105,490		50,000	63,700			219,190
Amador	195,500			75,000			270,500
Butte	618,500			3,400			621,900
Calaveras	108,800						108,800
Del Norte	21,050	502,596				496,080	1,019,726
El Dorado	1,205,130			407,060			1,612,190
Fresno	947,920			187,060			1,134,980
Humboldt	64,856	367,920		3,011		2,700	438,487
Inyo	575,208			145,939	235,170		956,317
Kern	63,507						63,507
Lassen	343,630			110,650			454,280
Los Angeles	164,475						164,475
Madera	172,525			10,040			182,565
Marin	30,800	1,960					32,760
Mariposa	554,701			51,660	101,925		708,286
Merced	61,162						61,162
Modoc	378,920				30,000		408,920
Mono	925,145		897,982	290,970	198,090		2,312,187
Monterey	41,310	31,250					72,560
Napa	100,000						100,000
Nevada	667,552			268,334			935,886
Orange	9,650						9,650
Placer	519,105			135,584			684,689
Plumas	1,287,340			112,360			1,399,700
Riverside	23,650						23,650
San Bernardino	287,560						287,560
San Diego	27,550						27,550
San Francisco	115,800						115,800
San Luis Obispo	17,850						17,850
San Mateo	15,550	65,700					81,250
Santa Barbara	7,620						7,620
Santa Clara	221,783						221,783
Santa Cruz	57,929	166,274					224,203
Shasta	963,330			55,960	109,250		1,128,540
Sierra	556,070			136,480			692,550
Siskiyou	606,950	394,986		97,028		3,265,073	4,364,037
Tehama	393,300			25,000			418,300
Trinity	321,400			74,720			396,120
Tulare	671,721			167,404			839,125
Tuolumne	604,577			185,962	41,370		831,909
Ventura	72,750						72,750
Yuba	63,120						63,120
Grand totals	14,220,786	1,530,686	947,982	2,607,322	715,805	3,763,853	23,786,434

TABLE 2

Hatchery Reared Warm-water Fishes—1946

	Number of fish
Largemouth bass	14,549
Sacramento perch	23,040
Bluegill sunfish	1,638
Total	39,227

TABLE 3

Fish Rescued—1946

Trout	
Steelhead	1,290,620
Brown	8
Total	1,290,628

Salmon	
King	383,581
Silver	135,090
Total	518,671

Warm-water Fishes	
Smallmouth black bass	51,717
Largemouth black bass	50,558
Spotted bass	15,900
Striped bass	113
Sacramento perch	50,000
Crappie	48,901
Squaretail catfish	290,138
Forkedtail catfish	388,469
Bluegill sunfish	85,680
Green sunfish	285,524
Warmouth	70,008
Sturgeon	4
Total	1,337,012

TABLE 1. FISH PLANTED—1947

Hatchery Reared Fish Planted in Each County

County	Trout					Salmon		Total number of fish
	Rainbow	Steelhead	Cutthroat	Eastern brook	Brown	King	Kokanee	
Alpine	194,100		149,100	74,600				417,800
Amador	144,000							144,000
Butte	601,800				15,000			616,800
Calaveras	144,696							144,696
Del Norte	27,550	346,900				470,700		845,150
El Dorado	1,452,162			201,410			75,000	1,728,572
Fresno	1,012,549			129,990				1,142,539
Glenn	12,600							12,600
Humboldt	64,235	246,055	33,610	2,600		25,200		371,700
Inyo	568,252			146,290	19,750			734,292
Kern	129,070							129,070
Lassen	599,480			43,900	14,580			657,960
Los Angeles	253,500							253,500
Madera	315,702			64,202				379,904
Marin	33,320							33,320
Mariposa	633,717			19,200	103,600			756,517
Merced	47,840							47,840
Modoc	402,240							402,240
Mono	1,068,157		180,800	407,301	381,690			2,037,948
Monterey	40,205	14,512						54,717
Napa	108,015							108,015
Nevada	1,117,862			194,271			100,000	1,412,133
Orange	4,350							4,350
Placer	909,520			63,572				973,092
Plumas	1,188,020			22,000	80,000			1,290,020
Riverside	55,150							55,150
San Bernardino	384,176							384,176
San Diego	45,000							45,000
San Luis Obispo	21,400							21,400
San Mateo	13,532							13,532
Santa Barbara	32,850							32,850
Santa Clara	31,500							31,500
Santa Cruz	36,685	141,452						178,137
Shasta	1,310,309			17,160	129,890			1,457,359
Sierra	648,772			40,190				688,962
Siskiyou	1,093,885	343,240		92,820		3,237,150		4,767,095
Solano	15,000							15,000
Tehama	315,600			10,000	60,000			385,600
Trinity	536,078	21,600		15,240				572,918
Tulare	880,726			113,052				993,778
Tuolumne	602,589			95,220	76,720		282,800	1,057,329
Ventura	54,120							54,120
Yuba	49,300							49,300
Grand totals	17,199,614	1,113,759	363,510	1,753,018	881,230	3,733,050	457,800	25,501,981

TABLE 2

Hatchery Reared Warm-water Fishes—1947

	Number of fish
Smallmouth bass	109,222
Largemouth bass	9,234
Sacramento perch	1,220
Bluegill sunfish	19,765
Total	139,441

TABLE 3

Fish Rescued—1947

Trout	
Rainbow	70
Steelhead	482,101
Brown	1,560
Total	483,731

Salmon	
King	5,569
Silver	14,015
Total	19,584

Warm-water Fishes	
Black spotted bass	787
Smallmouth bass	110,770
Largemouth bass	77,065
Green sunfish	4,941
Bluegill sunfish	52,350
Forkedtail catfish	65,031
Squaretail catfish	188,787
Crappie	47,834
Sacramento perch	1,224
Warmouth bass	16,046
Striped bass	4,954
Shad	4,000
Total	573,789

GAME STATISTICS

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PREDATORY ANIMAL CATCH BY COUNTIES

	July 1, 1946 to June 30, 1947				July 1, 1947 to June 30, 1948				Total for biennium
	Coyote	Bobcat	Other predators	Total	Coyote	Bobcat	Other predators	Total	
Alpine	42	3		45	10	1		11	56
Amador	62	10		72	43	7	14	64	136
Butte	111	3	281	395	98	8	196	302	697
Calaveras	3	1	1	5	53	11	1	65	70
Colusa	6	6		12	3	1	2	6	18
El Dorado	43	9	1	53	15		4	19	72
Fresno	201	58	85	344	257	1,272	633	1,017	1,361
Glenn	27	5		32	3	2		5	37
Humboldt	32	120	12	164	56	121	33	210	374
Imperial					7		91	98	98
Inyo	104	3	4	111	122	2		124	235
Kern	145	22	17	184	8	1	13	22	206
Kings	8	2		10					10
Lake	51	10		61	48	39		87	148
Lassen	451	50	151	652	649	39	77	765	1,417
Los Angeles	117	22	62	201	267	72	169	508	709
Madera	2			2	58	28	28	114	116
Mariposa	18	9	38	65	89	6	20	115	180
Mendocino						46	219	265	265
Merced	1	1	12	14	1	1	12	14	28
Modoc	26	1		27	96	6		102	129
Mono	99	6	3	108	71	3	3	77	185
Monterey	148	89	70	307	5	24	43	72	379
Nevada	13	1	1	15	54	7	29	90	105
Orange	44	76	8	128	14	12	21	47	175
Plumas	96	8	1	105	247	17		264	369
Riverside	217	45	31	293	196	36	19	251	544
Sacramento					3			3	3
San Benito	125	101	163	389	63	150	231	444	833
San Bernardino	291	104	47	442	232	95	94	421	863
San Diego	194	111	157	462	289	172	209	670	1,132
San Luis Obispo	171	119	221	511	109	115	466	690	1,201
Santa Barbara	368	37	21	426	204	41	6	251	677
Santa Clara					4	4	18	26	26
Santa Cruz	4	3	4	11	47	59	257	363	374
Shasta	118	19	11	148	78	16		94	242
Sierra	3	1	2	6	3			3	9
Siskiyou	39	11	2	52	90	16	24	130	182
Solano			23	23					23
Stanislaus	58	15	21	94	28	23	26	77	171
Tehama	69	4		73	77	23		100	173
Trinity	12	8		20	44	8		52	72
Tulare	95	28	226	349	318	31	261	610	959
Tuolumne	192	25		217	165	35	3	203	420
Ventura	265	42	16	323	211	48	15	275	598
Yolo	3	3	3	9			1	1	10
Yuba	38	3	9	50	27	5	1	33	83
Totals	4,112	1,194	1,704	7,010	4,462	1,459	3,239	9,160	16,170

	1946-47	1947-48
Average number of trappers	26	28
Miles of trapline	454,892	470,115
Number of sets	451,217	498,103
Number of days	8,288	9,627

GAME BIRD RELEASES

LIBERATION OF GAME FARM BIRDS, JANUARY 1, 1946

Through December 31, 1947

County	Ringneck	Reeves	Turkey	Chukar	Valley quail	Total
1. Alameda	857					857
2. Alpine						
3. Amador	542	2		155	6	705
4. Butte	4,294			150		4,444
5. Calaveras						
6. Colusa	967					967
7. Contra Costa	2,573			63		2,636
8. Del Norte						
9. El Dorado		16				16
10. Fresno	4,357			386		4,743
11. Glenn	3,594					3,594
12. Humboldt	834			5		839
13. Imperial	5,131			128		5,259
14. Inyo	4,532			214		4,746
15. Kern	7,080		40	582	200	7,902
16. Kings	1,644				65	1,709
17. Lake	494					494
18. Lassen	2,003					2,003
19. Los Angeles	1,029			1,428	55	2,512
20. Madera	432					432
21. Marin	1,243					1,243
22. Mariposa		108				108
23. Mendocino	940			150		1,090
24. Merced	5,280			171		5,451
25. Modoc	3,997			165		4,162
26. Mono	188			60		248
27. Monterey	164					164
28. Napa	2,567	23			29	2,619
29. Nevada						
30. Orange	768			21		789
31. Placer	283			374		657
32. Plumas	173			36		209
33. Riverside	2,614	358	61	1,079	36	4,148
34. Sacramento	1,736			16	19	1,771
35. San Benito	18		24	12		54
36. San Bernardino	2,603		34	2,068		4,705
37. San Diego	1,428			1,354	130	2,912
38. San Francisco						
39. San Joaquin	5,419					5,419
40. San Luis Obispo	165	112	44	440	93	854
41. San Mateo						
42. Santa Barbara	1,411	29	30	50		1,520
43. Santa Clara	744	50	54			848
44. Santa Cruz	513	15				528
45. Shasta	2,632	112		486		3,230
46. Sierra	1,139	212		36		1,387
47. Siskiyou	2,896			57		2,953
48. Solano	4,140		18	2	34	4,194
49. Sonoma	1,395		48			1,443
50. Stanislaus	3,405	44			12	3,461
51. Sutter	274					274
52. Tehama	2,093	152				2,245
53. Trinity						
54. Tulare	7,075			242		7,317
55. Tuolumne	383	45		129	23	580
56. Ventura	1,834			979		2,813
57. Yolo	1,760			28		1,788
58. Yuba	590					590
Totals	102,233	1,278	353	11,066	702	115,632

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